

I 1.94/2: 10/14

Man

July 10, 1977 issue follows
this issue



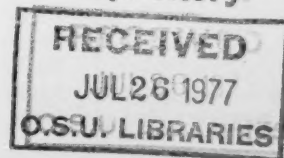
SELECTED ≡ WATER RESOURCES ABSTRACTS

TC 1
S45
V.10
no. 14



VOLUME 10, NUMBER 14
JULY 15, 1977

Depository



W77-06601 -- W77-07100
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Manager, Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior, Washington, DC 20240.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: SWRA Journal only, \$75; Journal and Annual Indexes, \$100; Indexes only, \$50. Other addressees, write prices.

SELECTED WATER RESOURCES ABSTRACTS

TC 1

S45

v.10

July-Aug. 1977

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
U.S. Department of the Interior



VOLUME 10, NUMBER 14
JULY 15, 1977

W77-06601 -- W77-07100

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department.

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

SELECTED WATER RESOURCES ABSTRACTS

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

WATER RESOURCES DIVISION

FOREWORD

Selectd Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD	iii
----------------	-----

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

- 01 NATURE OF WATER**
Includes the following Groups: Properties; Aqueous Solutions and Suspensions
- 02 WATER CYCLE**
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.
- 03 WATER SUPPLY AUGMENTATION AND CONSERVATION**
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.
- 04 WATER QUANTITY MANAGEMENT AND CONTROL**
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.
- 05 WATER QUALITY MANAGEMENT AND PROTECTION**
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.
- 06 WATER RESOURCES PLANNING**
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.
- 07 RESOURCES DATA**
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.
- 08 ENGINEERING WORKS**
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.
- 09 MANPOWER, GRANTS, AND FACILITIES**
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.
- 10 SCIENTIFIC AND TECHNICAL INFORMATION**
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

CLIMATOLOGY FOR GEOGRAPHERS, California Univ., Los Angeles, Dept. of Geography.
For primary bibliographic entry see Field 2B.
W77-06659

MATHEMATICAL MODELS IN HYDROLOGY. United Nations Educational, Scientific and Cultural Organization, Paris (France).
Proceedings of the Warsaw Symposium, Poland, July 1971, Volumes 1, 2, and 3. IAHS/Unesco, Paris, France, 1974. Vol 1-439 p, Vol 2-p 443-1110, Vol 3-p 1111-1351.

Descriptors: *Hydrology, *Mathematical models, *Research, *Methodology, *Optimization, *Water policy, *Operations research, Data collections, Structural analysis, Stochastic processes, Planning, Management, Water storage, Parametric hydrology, River systems, Lakes, Estuaries, Hydrodynamics, Constraints, Economics, Regional development, Systems analysis, Equations, *Water resources development, Reservoirs operation, *Simulation analysis.
Identifiers: Hydrologic sequences, Multi-dimensional processes, Conceptual catchment models, Objective functions, Cost minimization, Benefit maximization.

Volumes 1, 2, and 3 of this symposium contain some 140 articles, studies, reports, and discussions covering the comprehensive field of mathematical modeling in hydrology. This Proceedings belongs to the Studies and Reports in Hydrology series which is aimed at recording collected data and the main results of hydrological studies undertaken within the framework of the International Hydrological Decade (1965-74), launched by the General Conference of Unesco. The Proceedings contains the compilation of data, discussions of hydrological research techniques and findings, and guidance material for future scientific investigations. Each volume is divided into sections, based on the Conference sessions, dealing with a particular hydrological problem. Found in Volume 1 are: structural analyses of hydrological sequences; multi-dimensional processes in hydrology; and stochastic analyses of water storage problems. Volume 2 presents: the fitting of conceptual catchment models; distributed parameter catchment models and input fields; hydrodynamic models of river systems, lakes and estuaries; objective functions and constraints in water resources systems; optimal operation of water resources systems; and planning of systems for regional development in water resources. Volume 3 is comprised of a general report and a discussion on each of the 18 Conference sessions. It is hoped that these volumes will furnish material of both practical and theoretical interest to hydrologists and governments concerned with problems of water in all countries. (See W77-06709 thru W77-06737) (Bell-Cornell)
W77-06708

ON THE APPLICATION OF OPTIMIZATION TECHNIQUES TO CONCEPTUAL CATCHMENT MODELS, Technische Universitaet, Dresden (East Germany).
U. Grunewald, and S. Dyck.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 493-503. 7 fig, 1 tab, 23 ref.

Descriptors: *Parametric hydrology, *Optimization, *Reservoirs, *Channels, *Behavior, Storage, Statistical models, Mathe-

matical models, Equations, Methodology, Systems analysis, Watershed management.
Identifiers: *Experimental system identification, Second-order regression polynomial, Ridge line analysis, Conceptual models.

The application of the parametric method of experimental system identification is described. In particular, first results of applying two optimization methods to three conceptual models of catchment behavior are discussed. Only linear time-invariant systems are considered. With model (1), the known conceptual model of identical linear reservoirs in series is termed with the constant storage coefficient k . Model (2) results from the conceptual model of a series of alternating linear channels and linear reservoirs. Model (3) consists of a linear channel and two linear reservoirs of different storage coefficients, k_1 and k_2 , in series. The optimization methods used are: the method of the linearization of the normal-equations (method of LNE); and statistical optimization ('ridge-line analysis'). Results show that neglect of the variation of the translation time over the catchment (model (1)) does not yield a conceptual model of wide applicability. In the special cases of 'flat' impulse response functions, a good fit is obtained for model (1), whereas models (2) and (3) seem to be the models of widest applicability. (See also W77-06708) (Bell-Cornell)
W77-06709

USE OF A PARAMETRIC MODEL AS A TOOL FOR HYDROMETRIC NETWORK PLANNING, Waterloo Univ., (Ontario). Dept. of Civil Engineering.
S. I. Solomon, A. S. Qureshi, and U. Korngold.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 511-526. 6 fig, 1 tab, 9 ref.

Descriptors: *Networks, *Parametric hydrology, *Planning, Monthly, Flow, Regions, Hydrologic data, Methodology, Conjunctive use, Gaging stations, Meteorological data, Terrain analysis, Precipitation, Temperature, Evaluation, Constraints, Costs, Systems analysis, Mathematical models.
Identifiers: *Hydrometric networks, *Regional planning, *Data transfer, Network expansion, Budget allocation, Physiographical characteristics.

This paper discusses the potential of a parametric model, designed to generate monthly flows, as a tool for planning a regional hydrometric network. Development of the model and its use as a data transfer technique are described. Possible advantages over other techniques are emphasized. The methodology for applying the technique to hydrometric network design is outlined. (See also W77-06708) (Bell-Cornell)
W77-06710

INDICES OF WATER RESTRICTION AND WATER DEFICIENCY TOLERANCE, Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6A.
W77-06711

COLLECTIVE UTILITY: A SYSTEMS APPROACH TO WATER PRICING POLICY, Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 6C.
W77-06712

ON LARGE-SCALE SIMULATION OF GROUNDWATER FLOW SYSTEMS, Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 4B.
W77-06713

THE CONJUNCTIVE USE OF A MULTI-RESERVOIR SYSTEM AND A DUAL-PURPOSE DESALTING PLANT, Sahand Co., Tehran (Iran).
For primary bibliographic entry see Field 4B.
W77-06714

OPTIMAL OPERATIONS OF RESERVOIRS IN THE HARZ MOUNTAINS, Technische Universitaet, Brunswick (West Germany). Leichtweiss Inst. for Water Research.
For primary bibliographic entry see Field 4A.
W77-06715

OPTIMIZATION MODEL OF A SYSTEM OF TWO OPEN-CHANNEL HYDROPLANTS, Gdansk Technical Univ. (Poland). Inst. of Hydraulic Engineering.
For primary bibliographic entry see Field 4A.
W77-06716

METHODS FOR CONTROL OF THE REGIMES FOR WATER RESOURCES SYSTEMS, Moskovskii Energeticheskii Institut (USSR). Dept. of Hydropower.
For primary bibliographic entry see Field 4A.
W77-06717

OPTIMAL COMPLEX USE OF CONTROLLED WATER RESOURCES OF A BASIN, Akademiya Nauk SSSR, Moscow. Central Economic Mathematical Inst.
For primary bibliographic entry see Field 4A.
W77-06718

MATHEMATICAL MODEL OF WATER RESOURCES UTILIZATION IN A RIVER BASIN, Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 4A.
W77-06719

OPTIMIZATION OF A THREE-RESERVOIR SYSTEM BY DYNAMIC PROGRAMMING, Ministerio de Obras Publicas, Madrid (Spain). Geologico Servicio.
For primary bibliographic entry see Field 4A.
W77-06720

OPTIMAL DESIGN AND OPERATION OF RESERVOIR SYSTEMS, New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-06721

CONSTRUCTION AND ADJUSTMENT OF A TWO-LAYER MATHEMATICAL MODEL OF THE LLOBREGAT DELTA, Ministerio de Obras Publicas, Barcelona (Spain). Computer Centre.
For primary bibliographic entry see Field 4A.
W77-06722

INTEGRATION OF AQUIFERS IN FLOOD CONTROL PROJECTS, Technion - Israel Inst. of Tech. Haifa. Dept. of Agricultural Eng.
For primary bibliographic entry see Field 4A.
W77-06723

OPTIMAL SEASONAL AND SHORT-TERM OPERATION OF A RESERVOIR USED FOR FLOOD CONTROL AND WATER SUPPLY, Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-06724

Field 2—WATER CYCLE

Group 2A—General

STREAMFLOW REGULATION BY ARTIFICIAL RECHARGE FED FROM UPSTREAM SURFACE STORAGE: DERIVATION OF CONTROL RULES,
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-06725

THE METHODS OF DISTRIBUTION OF WATER RESOURCES IN RIVER DEVELOPMENT SYSTEMS,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 4A.
W77-06726

MODELE MATHEMATIQUE DE SIMULATION DU SYSTEME DES RESSOURCES HYDRAULIQUES SUPERFICIELLES DU LLOBREGAT,
Ministerio de Obras Publicas, Barcelona (Spain).
Study and Experimental Centre.
For primary bibliographic entry see Field 4A.
W77-06727

CONJUNCTIVE USE OF THE TAJO-SEGURA AQUEDUCT SURFACE SYSTEM AND THE AQUIFERS OF THE LA MANCHA AREA,
Ministerio de Obras Publicas, Madrid (Spain).
Geologico Servicio.
For primary bibliographic entry see Field 4B.
W77-06728

HYBRID COMPUTER ANALYSIS OF A COMBINED SURFACE WATER-GROUNDWATER SYSTEM,
City Univ., London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-06729

OPTIMAL PLANNING OF FLOWS IN MULTI-RESERVOIR HYDRO-POWER SYSTEMS,
Boeing Computer Services Inc., Seattle, Wash. Mathematical Analysis Unit.
For primary bibliographic entry see Field 4A.
W77-06730

A SECTOR MODEL FOR REGIONAL AND NATIONAL WATER RESOURCES PLANNING,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 6A.
W77-06731

HYDROLOGICAL EVALUATION OF CHANGES IN RUNOFF CHARACTERISTICS,
Hydrologic Engineering Center, Davis, Calif.
For primary bibliographic entry see Field 4A.
W77-06732

GENERAL DESCRIPTION OF THE VISTULA RIVER PROJECT AND BASIC PLANNING DATA,
Bureau of Studies and Designs for Hydraulic Structures, Warsaw (Poland).
For primary bibliographic entry see Field 4A.
W77-06733

THE MULTI-STEP METHOD FOR SIMULATION AND OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES,
Technical Univ., Warsaw (Poland). Inst. of Environmental Engineering.
For primary bibliographic entry see Field 4A.
W77-06734

THE OUT-OF-KILTER ALGORITHM AS A SINGLE-STEP METHOD FOR SIMULATION AND

OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES,
Water Resources Engineers Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 4A.
W77-06735

LA SCIENCE DES SYSTEMES DANS LA PLANIFICATION DES RESSOURCES EN EAU,
Catania Univ. (Italy). Istituto di Idraulica Idrologia Gestione Acque (Italy).
For primary bibliographic entry see Field 6A.
W77-06736

A DYNAMIC MULTISECTOR PROGRAMMING APPROACH TO REGIONAL WATER RESOURCE MANAGEMENT,
Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div.
For primary bibliographic entry see Field 6A.
W77-06737

A MODEL FOR THE WATER REGIME OF A DECIDUOUS FOREST WITH SPECIAL CONSIDERATION OF THE FUNCTIONAL INTER-RELATIONSHIPS AMONG METEOROLOGICAL FACTORS, SOIL WATER CONTENT AND EVAPOTRANSPIRATION, (IN GERMAN),
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
H. Item.
Eidg Anst Forstl Versuchswes Mitt 50(3), p 137-332, 1974.

Descriptors: *Mathematical models, *Water balance, *Deciduous forests, *Forests, Soil water, Soil moisture, Moisture content, Evapotranspiration.
Identifiers: Meteorological factors.

A mathematical model describing the water regime of a forest depending on meteorological conditions is proposed. In an application of the model, it should be possible to calculate the soil water content at any time during the vegetation period using that in spring and meteorological records. If soil moisture data are generated in this way, it should be possible to study the influence of drought on the mass increment of trees.—Copyright 1976, Biological Abstracts, Inc.
W77-06864

NUMERICAL MODELS OF WIND-DRIVEN CIRCULATION IN LAKES,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 2H.
W77-06958

COMPREHENSIVE MONITORING OF METEOROLOGY, HYDRAULICS, AND THERMAL REGIME OF THE SAN DIEGO AQUEDUCT, CALIFORNIA,
Geological Survey, Bay St. Louis, Miss. Water Resources Div.
For primary bibliographic entry see Field 2D.
W77-06973

2B. Precipitation

COASTAL METEOROLOGICAL NETWORKS TO DETERMINE EFFECTS OF NUCLEAR PLANT COOLING SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
E. Ryznar, D. G. Baker, and H. Moses.
Bulletin of the American Meteorological Society, Vol. 57, No. 12, p 1441-1446, December 1976. 3 fig, 1 tab.

Descriptors: *Networks, *Instrumentation, *Nuclear powerplants, *Michigan, *Lake Michigan, On-site investigations, Cooling water, Cooling towers, Powerplants, Winds, Temperature, Air temperature, Water temperature, Humidity, Precipitation(Atmospheric), Rain gages, Fog, Solar radiation, Measurement, Lakes, Coasts, Meteorology, *Air pollution effects.
Identifiers: *Nuclear powerplant effects.

Twenty-five meteorological stations are in operation inland from two nuclear power plants located on the Lake Michigan shoreline in southwestern lower Michigan. Their purpose is to provide data to enable meteorological effects of mechanical-draft cooling towers at the Palisades Nuclear Plant and a once-through cooling system at the Donald C. Cook Nuclear Plant to be evaluated. Temperature, relative humidity, and precipitation are measured at all stations, total solar radiation and wind velocity at four, and visibility at three. The stations, equipment, and calibration methods were described, and examples of types of meteorological analyses were presented. (Sims-ISWS)
W77-06643

WEATHER MODIFICATION IN THE SOVIET UNION-1976,
Arizona Univ., Tucson. Inst. of Atmospheric Physics.
For primary bibliographic entry see Field 3B.
W77-06644

ON THE STATUS OF HAIL SUPPRESSION,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 3B.
W77-06645

SIMPLE FORMULAE FOR THE ESTIMATION OF WET BULB TEMPERATURE AND PRECIPITABLE WATER,
Meteorological Office, Poona (India).
S. J. Reddy.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 27, No. 2, p 163-166, April 1976. 3 tab, 4 ref.

Descriptors: *Meteorological data, *Formulas, *Equations, Temperature, Air temperature, Humidity, Pressure, Atmospheric pressure, Water vapor, Weather data, Data processing, Correlation analysis, Regression analysis, Meteorology.
Identifiers: Precipitable water, Estimation equations, Wet bulb temperature.

A simple formula was developed for computing wet bulb temperature on electronic computers from dry bulb temperature, relative humidity, and pressure. The results obtained with the equation were compared with observed values and were found to be in good agreement. A simple relation was also derived between wet bulb temperature and precipitable water. The results obtained with this equation were compared with the observed values and were found to be in good agreement. (Sims-ISWS)
W77-06646

AREA-DEPTH RELATIONS FOR FREQUENCY VALUES OF RAINFALL,
Meteorological Office, New Delhi (India).
N. Tripathi.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 27, No. 2, p 173-176, April 1976. 2 fig, 2 tab, 5 ref.

Descriptors: *Rainfall, *Depth-area curves, *Depth-area-duration analysis, Precipitation(Atmospheric), Data processing, Networks, Rain gages, Foreign countries, Meteorological data, Weather data, Foreign research, Rainfall disposition, Weather patterns, Hydrologic data, Meteorology.
Identifiers: *India.

Based on rainfall data of 11 dense networks of rain gauges, area-depth curves for frequency values of rainfall for Indian regions were drawn and presented in this paper. The curves are for durations of 1, 3, 6, and 24 hours and for small basins up to 1000 sq km. An equation giving the area-depth relation for any duration was also worked out. (Sims-ISWS)
W77-06647

AN APPROXIMATING POLYNOMIAL FOR THE COMPUTATION OF SATURATION VAPOR PRESSURE,
Naval Environmental Prediction Research Facility, Monterey, Calif.
P. R. Lowe.
Journal of Applied Meteorology, Vol. 16, No. 1, p 100-103, January 1977. 1 fig, 1 tab, 7 ref.

Descriptors: *Saturation, *Vapor pressure, *Mathematical models, Numerical analysis, Atmosphere, Temperature, Thermodynamics, Moisture, Meteorological data, Algorithms.
Identifiers: *Polynomial procedure, Saturation vapor pressure, Atmospheric phenomenon.

A procedure for computing saturation vapor by means of a polynomial approximation was evaluated against other methods then in use. The polynomial procedure consumes a minimal amount of time, without sacrificing acceptable accuracy with respect to the standard. A literature review showed eleven different procedures for computing vapor pressure. These 11 procedures were divided into 2 basic categories: those that require exponentiation, and those that take the form of a polynomial. The requirement for doing an exponentiation, whether the base is e or 10, violates the criterion of economy of computing time. Yet, polynomial-type procedures characteristically have been inaccurate. The polynomial procedure was demonstrated to be highly accurate and more economic of computational time requirements than other procedures. (Roberts-ISWS)
W77-06652

A NOTE ON TEMPERATURE AND HUMIDITY PROFILE MEASUREMENT OVER FORESTS USING DIODES,
Queen's Univ., Kingston (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W77-06653

CLIMATOLOGY FOR GEOGRAPHERS,
California Univ., Los Angeles, Dept. of Geography.
W. H. Terjung.
Annals of the Association of American Geographers, Vol. 66, No. 2, p 199-222, June 1976. 9 fig, 120 ref.

Descriptors: *Climatology, *Reviews, *Methodology, Climates, Research priorities, Atmosphere, Evapotranspiration, Rainfall, Precipitation(Atmospheric), Water vapor, Humidity, Energy, Energy transfer, Geomorphology.
Identifiers: *Geography, Geographers, Physical geography.

Climatology was reviewed and redefined in terms of relevance to geography, and a programmatic statement for future research was presented. Instead of enumerating substantive areas, physical geography was defined and ranked according to five levels of methodology and attendant philosophy. The essence of geographical climatology is the analysis and description of process-response systems of importance to mankind occurring within the planetary boundary layer, interface, and substrates. The future of a climatology useful to geographers appears to lie in the numerical modeling of such systems. (Sims-ISWS)
W77-06659

AN ESTIMATE OF THE INPUT OF ATMOSPHERIC TRACE ELEMENTS INTO THE NORTH SEA AND THE CLYDE SEA (1972-3),
Atomic Energy Research Establishment, Harwell (England).
For primary bibliographic entry see Field 5B.
W77-06668

COMPRESSED AIR FOR SUPERCOOLED FOG DISPERSAL,
Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Meteorology Lab.
For primary bibliographic entry see Field 3B.
W77-06674

THE DISTRIBUTION OF NATURAL AND ANTHROPOGENIC ELEMENTS AND COMPOUNDS IN PRECIPITATION ACROSS THE U.S.; THEORY AND QUANTITATIVE MODELS,
North Carolina Univ., Chapel Hill. Dept. of Botany.
T. G. Wolaver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 233, Price codes: A05 in paper copy, A01 in microfiche.
EPA Report, NERC, Research Triangle Park, N.C., October 1972. 83 p, 36 fig, 8 tab, 28 ref. S-T2-WP-173-03, 04.

Descriptors: *Chemistry of precipitation, *Model studies, *Precipitation(Atmospheric), *Fallout, *Mathematical models, Rain, Rainwater, Weather, Rainfall, Rainfall intensity, Air pollution, Pollutants, Water quality, Chemical analysis, Chemical precipitation.
Identifiers: *Quantitative models, Wet fallout, Mineral constituents, Mineral nutrients.

In view of present concern over air pollution, spatial models and display of chemicals in rainwater become increasingly important. This publication attempted a contribution at three levels: (1) understanding the processes which are responsible for the negative exponential relationship between elemental concentration and precipitation, (2) attempting to quantify the negative exponential function for seven common elements and compounds, and (3) applying this information to produce computerized spatial displays (maps) of washout, rainout, and total wet fallout patterns in the United States for several chemicals. (Henley-ISWS)
W77-06675

INVESTIGATION OF THE EFFECTS OF NON-HOMOGENEOUS (OR NONSTATIONARY) BEHAVIOR ON THE SPECTRA OF ATMOSPHERIC TURBULENCE,
Bolt Beranek and Newman, Inc., Cambridge, Mass.
W. D. Mark, and R. W. Fischer.
NASA Contract Report 2745, October 1976. 113 p, 26 fig, 1 tab, 19 ref, 8 append. NASA NAS1-13709.

Descriptors: *Turbulence, *Atmosphere, *Model studies, Mathematical models, Numerical analysis, Equations, Winds, Meteorology.
Identifiers: *Atmospheric turbulence, Power spectra, Nonhomogeneous turbulence.

This report examined the effects of nonhomogeneous or nonstationary envelope behavior on the power spectra of atmospheric turbulence records. The principal vehicle used in the study was a new series expansion of the instantaneous power spectrum that has for its first term the usual quasi-stationary spectrum approximation. The minimum duration of a burst of turbulence and the minimum rise-time of an abrupt onset of turbulence that will not give rise to changes in the spectrum due to the nonstationary behavior were determined. A general criterion for envelope behavior that will not give rise to changes in the spectrum was also determined. Spectra computed from recorded turbulence time histories were shown to be consistent with the theoretical predictions. (Sims-ISWS)

W77-06678

USE OF A PARAMETRIC MODEL AS A TOOL FOR HYDROMETRIC NETWORK PLANNING,
Waterloo Univ., (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06710

INVESTIGATION OF PRECIPITATION WITHIN FOREST ECOSYSTEMS, (IN HUNGARIAN),
Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Botany.
M. Szabo.
Acta Biol Debrecina 12, p 155-162, 1975.

Descriptors: *Rain, *Forests, *Stemflow, *Water balance, *Rainfall, *Investigations, Ecosystems, Hydrologic cycle, Nutrients, Throughfall, Interception, Oak trees, Precipitation(Atmospheric).
Identifiers: Climate, Hungary, *Rainwater measurement.

The nutrient cycle is strongly geared to the hydrologic cycle. Definitions of throughfall, stemflow, interception, etc. are given, and the design of investigations on the hydrologic cycle of a sessile oak forest (*Quercetum petraeae-cerris*) is described in the framework of the 'Sikfokut Project' within the UNESCO (United Nations Educational Scientific and Cultural Organization) research program 'Man and Biosphere'. The sample area (100 by 100 m basic quadrat) is situated in the Bükk Mountains (Hungary). In a 50 by 50 m plot, the climate and water budget are investigated. Fourteen troughs 20 cm wide and 1 m long are randomly distributed to measure the rainwater under the forest canopy. Stemflow of 14 mean diameter trees is measured using polyurethane collars at a height of 1.30 m. Incident precipitation will be estimated above the tree crowns at the top of a 24 m high tower erected within the same plot. Investigations on precipitation and analysis of the nutrient content of rainfall passing through the canopy started in 1974.—Copyright 1976, Biological Abstracts, Inc.
W77-06797

LAKE ST. CLAIR HYDROLOGIC TRANSFER FACTORS,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W77-06879

A SINGLE FIELD OF VIEW METHOD FOR RETRIEVING TROPOSPHERIC TEMPERATURE PROFILES FROM CLOUD-CONTAMINATED RADIANCE DATA,
Texas A and M Univ., College Station. Center for Applied Geosciences.
D. B. Hodges.
NASA Contract Report 2726, August 1976. 103 p, 37 fig, 4 tab, 31 ref. NASA NAS8-26751.

Descriptors: *Remote sensing, *Air temperature, *Satellites(Artificial), Clouds, Model studies, Mathematical models, Data processing, Atmosphere, Cloud physics, Meteorological data, Meteorology.
Identifiers: *Temperature profiles, *NOAA-4.

Presented herein was a method of retrieving single field of view (FOV) tropospheric temperature profiles directly from cloud-contaminated radiance data through the use of auxiliary data such as observed shelter temperature and estimated cloud-top height. It was shown that a well-defined temperature profile may be calculated from the radiative transfer equation (RTE) for a partly cloudy atmosphere when the average fractional cloud amount and cloud-top height for the FOV are

Field 2—WATER CYCLE

Group 2B—Precipitation

known. A cloud model was formulated to calculate the fractional cloud amount from an estimated cloud-top height. The method was then examined through use of simulated radiance data calculated through vertical integration of the RTE for a partly cloudy atmosphere using known values of cloud-top height(s) and fractional cloud amount(s). Temperature profiles were retrieved from the simulated data, assuming various errors in the cloud parameters. Temperature profiles were retrieved from NOAA-4 satellite-measured radiance data obtained over an area dominated by an active cold front and with considerable cloud cover. Excellent radiosonde data for 11 stations participating in the Atmospheric Variability Experiment (AVE III) available for the area were used for comparison with temperature profiles retrieved from the NOAA-4 data. The effects of using various guessed profiles and the number of iterations were considered. (Sims-ISWS)

W77-06887

TIME-DISTRIBUTION OF STORM RAINFALL IN PENNSYLVANIA.

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

R. L. Kerr, T. M. Rachford, B. M. Reich, B. H. Lee, and K. H. Plummer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 251. Price codes: A09 in paper copy, A01 in microfiche. June, 1974. 173 p., 33 fig., 33 tab., 27 ref., 3 append.

Descriptors: *Time, *Storm water, *Storms, *Rainfall, *Pennsylvania, Rain gages, Floods, Antecedent precipitation.

A sample of 1623 storms obtained from the rainfall charts of 46 recording rain gage stations throughout Pennsylvania were analyzed. Each storm was large enough to have produced a flood, given the proper antecedent conditions. Percentage rainfall occurring in successive 5%, 10%, 25%, and 33.3% time intervals of storm duration were calculated for each storm. Ten percent of duration was best for noticing possible trends. Techniques used to identify storms with similar patterns included calculating a median mass curve for storms in each group, calculating limit curves including 80% of the data points around this median line, and calculating statistics for the percentage rainfall in each interval of 10% duration. A sample of 405 antecedent precipitation events associated with flood-producing storms in Pennsylvania was also analyzed. Antecedent rainfalls associated with each storm were listed for seven sequential 24 hr periods immediately before the start of the storm. Antecedent precipitation distributions were somewhat different during the growing and dormant seasons. Regional variations across Pennsylvania were insignificant. The occurrences of antecedent rainfalls were nearly independent statistically from the ensuing flood-producing storms. (Snyder-FIRL)

W77-07022

2C. Snow, Ice, and Frost

SUPRAPERMAFROST WATER.

Alaska Univ., College. Inst. of Water Resources. G. L. Guymon.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 955. Price codes: A02 in paper copy, A01 in microfiche. Report No. IWR-53, June 1974, 11p. OWRT C-4049 (No. 9010)(3).

Descriptors: *Permafrost, Cold-regions, Soil mechanics, Moisture, *Hydraulic conductivity, *Soil water movement, Model studies, Heat balance, Soil moisture, Freezing, Thawing, Convection, Boundary processes.

Identifiers: *Suprapermafrost water, *Freezing soils, *Thawing soils.

The objective was to extend the quantitative knowledge of the soil-water regime of permafrost soils as it is related to hydrological analysis. Research indicated that the most dynamic and perhaps most important soil water behavior occurs during the winter. There is evidence that a significant amount of water is lost to the atmosphere from the frozen soil. Evidence also suggests that an appreciable amount of heat may be convected by moisture migration. In most instances, water is driven by hydraulic gradients produced by the freezing part of the soil profile. In addition, a one-dimensional, coupled heat and moisture transport model was developed for freezing and thawing soils. The most important result to come from the modeling effort was the conclusion that such modeling, when applied on a regional basis, is of little applied value unless means are perfected for determining accurately (1) the hydraulic conductivity parameter for freezing soils, (2) the ice-water ratio function, and (3) the boundary conditions at the soil surface for both moisture and thermal states. (Hartman-Alaska)

W77-06630

LABORATORY STUDY OF THE FLEXURAL STRENGTH AND ELASTIC MODULUS OF FRESHWATER AND SALINE ICE.

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

J. C. Tatinciaux, and C. Y. Wu.

IHR Report No. 190, June 1976. 148 p., 53 fig., 32 tab., 9 ref., 2 append. Army DACA89-75-G-052.

Descriptors: *Ice, *Strength, *Elasticity(Mechanical), *Laboratory tests, Strength of materials, Ice loads, Freshwater, Saline water, Salinity, Crystals, Temperature, Equipment, Loads(Forces), Mechanics.

Identifiers: *Bending strength, *Elastic modulus.

Results are presented of a laboratory investigation of the bending strength and elastic modulus of seeded, freshwater and saline ice. Small freshwater ice beams with homogeneous temperature distribution were tested under concentrated load and pure bending applied either on the top or on the bottom surface of the specimens. Freshwater ice and saline ice beams were also tested under pure bending in a water bath. The significant difference in the values of sigma and E obtained with freshwater ice samples at homogeneous temperature, depending on whether the specimens were loaded on the top or bottom surface, was attributed to the variation in ice crystal size between the top and bottom surfaces of the ice sheet. No noticeable effect of loading rate on the flexural strength of both freshwater and saline ice was found, while the elastic modulus appeared to increase slightly with increasing loading rate. Air temperature was found to have only a minor effect on strength and elastic modulus, at least in the range of temperature investigated. On the other hand, both the bending strength and the elastic modulus were found to be very rapidly decreasing functions of the square root of the brine volume. In view of the difficulties encountered during the experimental program and in the interpretation of the results, it was recommended that further investigation be carried out on the effect of specimen dimensions, testing methods, ice crystal size, and size and distribution of brine pockets on the flexural strength and elastic modulus of saline ice. (Sims-ISWS)

W77-06661

IDENTIFICATION, DOCUMENTATION, AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA, AND THE DISTRIBUTION, ABUNDANCE AND FEEDING ECOLOGY OF BIRDS ASSOCIATED WITH PACK ICE.

Alaska Dept. of Fish and Game, Fairbanks.

For primary bibliographic entry see Field 6G.

W77-06805

AN ANNULAR FLOW ICE-WATER MODEL HEAT SINK.

Cold Regions Research and Engineering Lab., Hanover, N. H. Experimental Engineering Div.; and Cold Regions Research and Engineering Lab., Hanover, N. H. Northern Engineering Research Branch.

J. L. Brown, and W. F. Quinn.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-015 468. Price Codes: A04 in paper copy, A01 in microfiche. Special Report 236, September 1975. 71 p., 16 fig., 26 ref., 7 append.

Descriptors: *Powerplants, *Water cooling, *Ice, *Ice-water interfaces, Heat transfer, Melting, Nuclear powerplants, Nuclear reactors, Cooling water, Model studies, Computer models, Laboratory tests.

Identifiers: *Heat sinks, Reactor coolants.

An analytical and laboratory experimental study was conducted on a scale model annular flow ice-water heat sink. The study developed: (1) an understanding of the flow processes and melting patterns in such a sink, (2) a mathematical procedure for predicting relationships between coolant water and heat rejection rates, (3) a validation of the math procedure using a scaled experiment model, and (4) an assessment of the effect of some water inlet manifold configurations. Advantageous performance characteristics include provision for (1) maximum thermal efficiency during the early (probably most crucial) stages of use, and (2) a relatively constant outlet sink temperature to the power plant heat exchanger during the ice melting period. (Sims-ISWS)

W77-06889

DEVON ISLAND ICE CAP: CORE STRATIGRAPHY AND PALEOCLIMATE.

Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.

R. M. Koerner.

Science, Vol. 196, No. 4285, p 15-18, April 1, 1977. 4 fig., 1 tab., 21 ref.

Descriptors: *Ice, *Climatology, *Polar regions, *Canada, Freezing, Ablation, Melting, Melt water, Glaciers, Ice cover, Seasonal, Sea ice, Climates, Stratigraphy, Cores, Core logging, Cold regions.

Identifiers: *Ice caps, Devon Island ice cap(NWT).

Valuable paleoclimatic information can be gained by studying the distribution of melt layers in deep ice cores. A profile representing the percentage of ice in melt layers in a core drilled from the Devon Island ice cap plotted against both time and depth showed that the ice cap has experienced a period of very warm summers since 1925, following a period of colder summers between about 1600 and 1925. The earlier period was coldest between 1680 and 1730. There is a high correlation between the melt-layer ice percentage and the mass balance of the ice cap. The relation between them suggests that the ice cap mass balance was zero (accumulation equaled ablation) during the colder period but is negative in the present warmer one. There is no firm evidence of a present cooling trend in the summer conditions on the ice cap. A comparison with the melt-layer ice percentage in cores from the other major Canadian Arctic ice caps shows that the variation of summer conditions found for the Devon Island ice cap is representative for all the large ice caps for about 90% of the time. There is also a good correlation between melt-layer percentage and summer sea-ice conditions in the archipelago. This suggests that the search for the northwest passage was influenced by changing climate, with the 19th-century peak of the often tragic exploration coinciding with a period of very cold summers. (Sims-ISWS)

W77-06890

Streamflow and Runoff—Group 2E

RIVER BASIN SNOW MAPPING AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE,

National Environmental Satellite Service, Washington, D.C.

S. R. Schneider, D. R. Wiesnet, and M. C. McMillan.

NOAA Technical Memorandum NESS 83, November 1976. 19 p, 8 fig, 1 tab, 17 ref.

Descriptors: *River basins, *Snow surveys, *Mapping, *Satellites(Artificial), Snowfall, Snow cover, Meteorology, Meteorological data, Flood forecasting, Data collections.
Identifiers: *National Environmental Satellite Service(NESS), Photo-interpretative techniques, Radiometers, Snow measurement.

The development of the operational river basin snow mapping program at the National Environmental Satellite Service was described. Satellite-derived areal snow cover measurements were provided for over 20 river basins to federal and state agencies around the United States. The snow maps were made, and results were disseminated within 24 hours of a satellite pass over a study basin. The satellite sensors used in snow mapping, the methodology, possible sources of error, and quality control techniques also were described. The key element in the application of snow mapping to hydrological forecasting was the decision to map snow distribution basin by basin. This decision made the data applicable to modeling and to the buildup of data sets of climatic significance. Reliable snow cover data had never before been available to the climatologists and hydrologists. The statistical analysis of such data sets should be a powerful new tool that can be applied to river forecasting in local basins as well as to continental climatic studies. (Roberts-ISWS)
W77-06915

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1974-75,

Environmental Protection Service, Ottawa (Ontario).

For primary bibliographic entry see Field 5D.
W77-06948

2D. Evaporation and Transpiration**AN APPROXIMATING POLYNOMIAL FOR THE COMPUTATION OF SATURATION VAPOR PRESSURE,**

Naval Environmental Prediction Research Facility, Monterey, Calif.

For primary bibliographic entry see Field 2B.

W77-06652

A NOTE ON TEMPERATURE AND HUMIDITY PROFILE MEASUREMENT OVER FORESTS USING DIODES,

Queen's Univ., Kingston (Ontario). Dept. of Geography.

For primary bibliographic entry see Field 7B.
W77-06653

EVAPORATION AND ADVECTION II: EVAPORATION DOWNWIND OF A BOUNDARY SEPARATING REGIONS HAVING DIFFERENT SURFACE RESISTANCES AND AVAILABLE ENERGIES,

Department of Scientific and Industrial Research, Lincoln (New Zealand). Crop Research Div. K. G. McNaughton.

Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 431, p 193-202, January 1976. 1 fig, 6 ref, 1 append.

Descriptors: *Evaporation, *Advection, *Surfaces, *Energy, Homogeneity, Latent heat, Vapor pressure, Heat transfer, Heat resistance, Model studies, Equations, Mathematical studies.

Identifiers: *Surface resistance, Bowen ratio, Sensible heat, Moisture transfer, Heat flux, Net radiation, Psychrometric constant.

Using the model and methods developed in Part I of this study, it was shown that steady-state evaporation, downwind of a sharp boundary separating uniform regions with constant but different surface resistances and available energies, can be written as $LE = (s/(s + \gamma)) (R_n - G) + (s/(s + \gamma)) (1/r(r'(R_n - G) - r(R_n - G))) \Phi$, where Φ is a dimensionless 'exchange function' that decreases from unity to zero as distance increases downwind of the boundary. The symbols have their conventional meanings, and the primes signify upwind values. The form of Φ depends (1) on the profiles of wind speed and effective diffusivity, and (2) on the downwind surface resistance and temperature via the parameter $(\gamma r)/(s + \gamma)$. Empirical expressions for Φ were obtained (1) from a known solution of the atmospheric diffusion equations, assuming power law forms of the wind speed and effective diffusivity profiles, and (2) from a simple model assuming perfect vertical mixing and constant wind speed beneath an impermeable inversion base. These may give some indication of the form and magnitude of Φ at small and at large distances respectively. (Jones-ISWS)
W77-06897

PROFILES AND EVAPORATION,

Rothamsted Experimental Station, Harpenden (England).

H. L. Penman, and I. F. Long.

Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 434, p 841-855, October 1976. 10 fig, 1 tab, 3 ref.

Descriptors: *Evaporation, *Stability, *Profiles, *Equations, Humidity, Temperature, Weight, Winds, Transportation, Shear stress, Crops.

Identifiers: Weighting factors, Lapse rate, Kale.

In all conditions of stability, either of two slightly different profile equations could be used, both carrying built-in stability weighting factors for use in transport equations. Profiles of wind, temperature, and humidity, above and within two large plots of kale (one irrigated), were studied in detail for short periods of strong lapse and strong inversion. The objectives of the study were to show the high quality in anemometry needed to exploit the profile equation, to demonstrate a way of correcting for zero errors in the thermometry, and to show that above the crop, the profiles of wind and water vapor pressure have the same shape. Within the crop, in both lapse and inversion, the top of the crop is the source or sink for sensible heat transfer. In a humidity inversion, the top is also the sink for latent heat transfer. But in a lapse, the source is at, or close to, the virtual sink momentum. (Roberts-ISWS)
W77-06898

COMPREHENSIVE MONITORING OF METEOROLOGY, HYDRAULICS, AND THERMAL REGIME OF THE SAN DIEGO AQUEDUCT, CALIFORNIA,

Geological Survey, Bay St. Louis, Miss. Water Resources Div.

H. E. Jobson, and A. M. Sturrock, Jr.

Open-file report 76-628, August 1976. 102 p, 31 fig, 6 tab, 5 ref.

Descriptors: *Energy budget, *Hydrologic cycle, *Aqueduct, *California, *Evaporation, Canals, Data collections, Methodology, Water temperature, Meteorological data, Wind velocity, Solar radiation, Vapor pressure, Flow rates, Evaluation, Forecasting, *Monitoring.

Identifiers: *San Diego Aqueduct(Calif), Concrete-lined canal, Atmospheric radiation, Hydraulic variables.

Water temperature, as well as meteorologic and hydraulic variables which influence the energy budget of the San Diego Aqueduct in southern California, were continuously monitored for a 1-year period beginning July 24, 1973. Incoming solar and atmospheric radiation, windspeed and direction, water temperature, and wet- and dry-bulb air temperatures were recorded at 10-minute intervals at each end of the 26-km concrete-lined canal, while flow rates and stages were determined at hourly intervals for five locations. Although only daily averaged values are presented in this report, all information necessary for the use and interpretation of these data are presented. Windspeeds were minimum during the early morning hours and maximum during the late afternoon; however, they were variable spatially. On the other hand, incoming radiation and absolute vapor pressure varied little from point to point. (Woodard-USGS)
W77-06973

2E. Streamflow and Runoff**EVALUATION OF THE ENVIRONMENTAL IMPACT TO APPALACHIAN PENNSYLVANIA WATERS OF THE 1972 FLOOD AND SUBSEQUENT STREAM CHANNELIZATION WITH FUTURE POLICY RECOMMENDATIONS.**

Baker (Michael), Jr., Inc., Beaver, Pa.

For primary bibliographic entry see Field 4A.
W77-06676

MATHEMATICAL MODELS IN HYDROLOGY.

United Nations Educational, Scientific and Cultural Organization, Paris (France).

For primary bibliographic entry see Field 2A.
W77-06708

FORECASTING FLOODS IN HAWAII (EXCLUDING HAWAII ISLAND),

National Weather Service, Honolulu, Hawaii. Pacific Region.

For primary bibliographic entry see Field 4A.
W77-06873

LAKE ST. CLAIR HYDROLOGIC TRANSFER FACTORS.

National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 2H.
W77-06879

SURFACE WATER NETWORK DESIGN BY REGRESSION ANALYSIS SIMULATION,

Geological Survey, Reston, Va. Water Resources Div.

M. E. Moss, and M. R. Karlinger.

Water Resources Research, Vol. 10, No. 3, p 427-433, June 1974. 7 fig, 1 tab, 5 ref.

Descriptors: *Network design, *Surface waters, *Streamflow, *Regression analysis, Methodology, Synthetic hydrology, Stochastic processes, Flow rates, Average flow, Regional analysis, *Simulation analysis.

The statistical characteristics of the accuracy of regression analyses as used in surface water regionalization are investigated by simulating logarithmic regressions of the streamflow parameters, mean and standard deviation, derived from synthetic streamflow sequences. Accuracy is measured in terms of equivalent years of at-site record. A procedure for the design of surface water data networks that accounts for the statistical nature of the estimates of parameter accuracy is presented. (Woodard-USGS)
W77-06963

Field 2—WATER CYCLE

Group 2E—Streamflow and Runoff

DELAWARE RIVER: EVIDENCE FOR ITS FORMER EXTENSION TO WILMINGTON SUBMARINE CANYON.
Geological Survey, Woods Hole, Mass. Geologic Div.
D. C. Twichell, H. J. Knebel, and D. W. Folger.
Science, Vol 193, No 4277, p 483-485, February 1977. 2 fig, 10 ref.

Descriptors: *Delaware River, *History, *Pleistocene epoch, *River flow, *Seismic studies, Geology, Sedimentology, Valleys, Delaware, Maryland.
Identifiers: *Ancestral channels, Directional flow.

During times of lowered sea level, the rivers along the east coast of the United States flowed across the subaerially exposed continental shelf. The ancestral channels of these rivers were subsequently buried or partially obliterated by erosion during sea-level transgressions. As a result, only a few channels have been traced across the shelf. Seismic-reflection profiles indicate that during the Pleistocene the Delaware River flowed across the continental shelf east of Delaware Bay and emptied into Wilmington Submarine Canyon. The ancestral valley (width, 3 to 8 kilometers; relief, 10 to 30 meters) is buried, is not reflected in the surface topography, and probably predates the formation of the present canyon head. (Woodard-USGS)
W77-06966

FLOODS IN LOUISIANA, MAGNITUDE AND FREQUENCY, THIRD EDITION.
Geological Survey, Baton Rouge, La. Water Resources Div.
B. L. Neely, Jr.
Louisiana Department of Highways, Baton Rouge, 1976. 340 p, 16 fig, 1 tab, 17 ref.

Descriptors: *Floods, *Louisiana, *Historic floods, *Frequency analysis, *Flood data, Flood forecasting, Regression analysis, Equations, Maximum probable flood, Peak discharge, Rainfall-runoff relationships, Hydrologic data, Gaging stations, Drainage area, Natural flow, Flood recurrence interval, Flood control.

Techniques are presented for estimating the magnitude and frequency of peak discharges on streams in Louisiana. A comprehensive analysis was made in which physical and climatic characteristics of river basins are related to flood characteristics at gaging stations. Equations derived from the analysis make it possible to estimate the magnitude of peak discharges with recurrence intervals of 2 to 100 years on streams that have drainage areas less than 3,000 square miles if the drainage-area size, main-channel slope, and mean annual precipitation are known. The equations should not be used where regulation by man appreciably affects flood runoff. Data from 170 gaging stations with 9 or more years of record were used in the analysis. Flood frequency at each gaging station was computed by fitting a log-Pearson Type III distribution to gaging-station data. Flood records for all gaging stations in Louisiana are tabulated. Graphical relations of maximum floods of record to drainage area at gaging stations are shown to provide a guide to maximum probable floods. A method is described for estimating the magnitude and frequency of peak discharges on stream for urban areas in Louisiana. (Woodard-USGS)
W77-06979

TIME-DISTRIBUTION OF STORM RAINFALL IN PENNSYLVANIA.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 2B.
W77-07022

2F. Groundwater

LAND FORMING SYSTEMS TO IMPROVE WATER USE EFFICIENCY.
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-06761

FURTHER DEVELOPMENT AND TESTING OF A STREAM-AQUIFER SYSTEM MODEL.
Kansas Water Resources Research Inst., Lawrence.
E. C. Pogge, and W. L. Chiang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 016, Price Code: A09 in paper copy, A01 in microfiche. KWRRI Contribution No. 185, January 1977. 185 p, 41 fig, 4 tab, 112 ref, 5 append. OWRT A-055-Kan(2).

Descriptors: *Groundwater, *Alluvial aquifers, Model studies, *Mathematical models, *Simulation analysis, *Kansas, Computer programs, Base flow, Flood routing, Channel flow, *Aquifer testing.
Identifiers: *Stream-aquifer models, *Channel routing, Bank seepage, *Walnut Creek Basin(Kan).

A mathematical model was developed from theoretical models, presently available, for simulating the response of an alluvial aquifer to the passage of a flood wave through a stream channel. The model consists of a procedure for routing the flood wave through the channel system, a groundwater flow model, and a method for coupling the stream channel system to the alluvial aquifer. The model was programmed for solution on a digital computer. The primary objective was to test the model on a natural system using historic data. In the testing, the model was applied to a reach of channel in Walnut Creek Basin located in west-central Kansas. Several modifications of the model were necessary to adapt it to the existing physical system. The test program both verified the applicability of the model to a natural physical system and also revealed the type of field data required for the proper application of the model.
W77-06762

PRELIMINARY BIBLIOGRAPHY ON GROUNDWATER IN DEVELOPING COUNTRIES.
Association of Geoscientists for International Development, St. John's (Newfoundland).
D. A. V. Stow, J. Skidmore, and A. R. Berger.
The Geosciences in International Development, Report No. 4, November, 1976. 305 p, 3 append.

Descriptors: *Bibliographies, *Publications, *Groundwater, Subsurface waters, Water resources, Data storage and retrieval, Aquifers, Foreign countries, Karst, Exploration, Water chemistry, Water quality, Management, Planning, Model studies, Surveys, Groundwater resources, Water wells.
Identifiers: *Developing countries(Groundwater).

This bibliography provides a guide to recent work on the subsurface water resources of developing countries. It lists 1,574 reference items, each dealing at least in part with groundwater and related directly to developing countries, published in 1970 or later. There are indexes by country and by subject. The references were collected primarily from nine computerized data bases, but use was made of published bibliographies not specifically dealing with developing countries and of personal compilations contributed by a number of hydrogeologists with international interests and experience. The sources are listed in the appendices together with a number of additional bibliographies not consulted directly. This bibliography is the most complete listing known on the subject of ground water in developing countries. (Heiss-NWA)
W77-06852

PERFORMANCE OF A RECHARGE AND RECOVERY SYSTEM IN AN AQUIFER WITH UNIFORM FLOW.
Technische Hogeschool, Delft (Netherlands). Geophysical Lab.
P. A. Vermeer, and C. van den Akker.
Hydrological Sciences Bulletin, Vol 21, No 3, p 387-396, September 1976. 8 fig, 2 ref.

Descriptors: *Potential flow, *Wells, *This equation, *Water supply development, *Groundwater recharge, *Recharge wells, Recharge, Groundwater, Analysis, Discharge(Water), Conjunctive use, Steady flow, Unsteady flow, Water storage, Well spacing.
Identifiers: Two-dimensional flow.

Flow from an injection well to a pumping well was considered in an aquifer with an initial uniform flow. Since the capacities of the wells were taken to be equal, it was believed that the wells disturb the uniform flow only locally. However, it was found that downstream from the wells the natural groundwater is replaced by injected water. A formula for this (steady) exchange was derived, assuming an abrupt interface between the two fluids and a constant pumping rate. The additional (unsteady) exchange due to a non-constant rate of injection was computed for the case when the pumping well is placed exactly downstream from the injection well. Under this special condition the steady exchange is equal to zero. (Adams-ISWS)
W77-06905

TABLES AND TYPE CURVES FOR ANALYSIS OF PUMP TESTS IN LEAKY PARALLEL-CHANNEL AQUIFERS.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 4B.
W77-06941

COMPARISON OF ITERATIVE METHODS OF SOLVING TWO-DIMENSIONAL GROUNDWATER FLOW EQUATIONS.
Geological Survey, Reston, Va. Water Resources Div.
P. C. Trescott, and S. P. Larson.
Water Resources Research, Vol 13, No 1, p 125-135, February 1977. 13 fig, 1 tab, 20 ref.

Descriptors: *Groundwater movement, *Subsurface flow, *Model studies, *Mathematical models, *Equations, Methodology, Evaluation, Correlation analysis, Aquifer characteristics, Hydrogeology.
Identifiers: *Finite-difference equations.

The efficiency of line successive overrelaxation (LSOR) is compared with a two-dimensional correction procedure (2DC), the iterative, alternating direction implicit procedure (ADI), and the strongly implicit procedure (SIP) to solve finite-difference equations used to simulate several groundwater reservoirs. Three of the reservoirs are linear, two are isotropic areal problems, and the third is an anisotropic cross-section simulation. The fourth is a nonlinear water table aquifer with areas of thin saturation. SIP is generally the best method for the linear simulations and with the addition of another iteration parameter is the only method that gives an adequate rate of convergence for the water table problem. LSOR with 2DC is competitive with SIP on isotropic and anisotropic linear problems that are dominated by no-flow boundaries. ADI is generally more efficient than LSOR if a good set of iteration parameters are used, but this advantage is offset by the relative ease of finding the best acceleration parameter for LSOR. (Woodard-USGS)
W77-06965

ANALOG-MODEL SIMULATIONS FOR SECONDARY CANAL CONTROLS AND FOR-

WARD PUMPING WATER-MANAGEMENT SCHEMES IN SOUTHEAST FLORIDA. Geological Survey, Tallahassee, Fla. Water Resources Div. For primary bibliographic entry see Field 4B. W77-06968

HYDROLOGIC INTERPRETATION OF GEOPHYSICAL DATA FROM THE SOUTHEASTERN HUECO BOLSON, EL PASO AND HUDSPETH COUNTIES, TEXAS. Geological Survey, El Paso, Tex. Water Resources Div. For primary bibliographic entry see Field 4B. W77-06970

GEOLOGY AND GROUND WATER IN DOOR COUNTY, WISCONSIN, WITH EMPHASIS ON CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITES. Geological Survey, Madison, Wis. Water Resources Div. For primary bibliographic entry see Field 5B. W77-06975

APPLICATION OF DIGITAL MODELLING TO THE PREDICTION OF RADIOISOTOPE MIGRATION IN GROUNDWATER. Geological Survey, Menlo Park, Calif. Water Resources Div. For primary bibliographic entry see Field 5B. W77-06981

2G. Water In Soils

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMATILLA DRAINAGE BASIN. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. J. A. Norgren, and G. H. Simonson. Prepared for the Oregon State Water Resources Board, 1969, Appendix 1-7. 73 p, 3 fig, 10 tab, 2 map.

Descriptors: *Soils, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, *Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone. Identifiers: *Umatilla River Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, *Erosion hazard, *Temperature limitation.

Soil survey information of the National Cooperative Soil Survey program in Oregon was used to map, describe and interpret soils in the Umatilla River Basin in northern Oregon. Soils are interpreted with regard to water use and management. Soil series consist of soils essentially uniform in characteristics such as texture, structure, arrangement of horizons, etc. Poorly drained and alkali soils with hardpans impeding drainage are found mostly in Umatilla County, with some problems also in Morrow County. Both alkali and drainage conditions can be altered by man's activities. Twelve soil or land characteristics are used in a guide for placing soils in irrigation groups; these characteristics are rated excellent, good/fair, poor, very poor/nonirrigable. Athena, Palouse, Ritzville, Sagemoor (Warden) and Walla Walla soils have excellent irrigation suitability. A total of 36 soil series were found unsuited for irrigation because of stoniness or steep slopes. Soils subject to occasional flooding are Esquatzel, Hermiston, Onyx, Pedigo, Stanfield, Umapine, and Yakima. Soils with the highest potential for runoff are Bakeoven, Bakeoven-biscuit complex, Ephrata-shallow, Licksillet, McKay, Rock Creek, Rock Creek-Waha complex, Rockland, and Starbuck. All soils are analyzed in terms of runoff, permeability, available water-holding capacity (AWHC),

effective root zone, shrink-swell potential, workability, erosion hazard, and temperature limitations. Detailed descriptions are given of soil series and mapping units in the Umatilla Drainage Basin. (Gentry-NC) W77-06602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREA, GRANDE RONDE DRAINAGE BASIN. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. H. M. Vance, M. G. Lindsay, and G. H. Simonson. Prepared for the Oregon State Water Resources Board, 1969, Appendix 1-8. 69 p, 2 fig, 11 tab, 2 map.

Descriptors: *Soils, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, *Infiltration, *Runoff, *Irrigation, *Infiltration rates, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone. Identifiers: *Grande Ronde Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, *Erosion hazard, *Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are given for 3,180,000 acres of the Grande Ronde Drainage Basin in northeast Oregon, 550,000 acres of which are suited for crop and improved pasture land. Information used in this report is based on data collected by the National Cooperative Soil Survey program in Oregon. The basin has a wide variety of terrain reflecting uplift and deep dissection of lava plateaus, mountain glaciation, and deposition in structural valleys. Aeolian deposits of loess and volcanic ash are widespread. Poorly drained and sodic soils include Wilkins, Haines, Hoopal and Hot Lake Soils. Four irrigation suitability ratings are used for rating 12 soil/land characteristics for irrigability. Soils suitable for irrigation are Alicel, (By), Imbler and Palouse soils. A total of 20 soils are unsuited for irrigation due to slopes greater than 20% and due to stoniness, depth, extreme elevations and temperatures, or some combinations of these factors. Soils subject to occasional flooding are (By), Catherine, Haines, Hot Lake, (Ne), (Sl), Veazie and Wilkins. Soils with the highest potential for runoff are soils shallow to bedrock, claypan, hardpan, clayey soils or poorly drained soils; 9 soils are included in this group. Soils are analyzed in terms of runoff potential, infiltration, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, temperature limitations. Soil interpretations relate to water use and management. Descriptions are given of the soil series and mapping units identified in the Basin and shown on the soil map. (Gentry-NC) W77-06603

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, POWDER DRAINAGE BASIN. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. M. G. Lindsay, and G. H. Simonson. Prepared for the Oregon State Water Resources Board, 1969, Appendix 1-9. 66 p, 2 fig, 10 tab, 2 map.

Descriptors: *Soils, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, *Infiltration, *Infiltration rates, *Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone. Identifiers: *Powder Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, *Erosion hazard, *Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 2,048,500 acres of the Powder Drainage Basin in northeast Oregon, 400,000 acres of which are suitable for crops or improved pasture. Soil information presented is needed for general planning of resource development in the Powder Basin, with soils being interpreted in terms of water use and management. Soils are analyzed in the Wallowa and Elkhorn Mountains, forested uplands, grassland uplands, and valley lands. Poorly drained and alkali soils are hershal, (Rb), Baldock, Haines, Stanfield and Umapine. Twelve soil/land characteristics are rated for irrigation suitability. Jett and Powder soils are excellently suited for irrigation. Thirty of the 48 soils described are poorly suited for irrigation due to stoniness, texture, depth or temperature, or due to excessive slope. Soils subject to occasional flooding are Baldock, Balm, Catherine, Goodrich, Haines, Hershal, Jett, Langrell, Powder, (Rb), Stanfield, Umapine and Wingville. Soils with greatest potential are soils which are very shallow to bedrock, clayey soils and poorly drained soils, and include Bakeoven, Halfway, Hershal, (Rb), Rock Creek, and rough mountainous land. Soils are analyzed according to runoff, infiltration, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard and temperature limitation. Descriptions are given of the soil series and land types identified in the Powder Basin and shown on the soil map. Soil information is based on the National Cooperative Soil Survey program in Oregon. (Gentry-NC) W77-06604

OREGON'S LONG RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR RIVER DRAINAGE BASIN. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. B. B. Lovell, M. G. Lindsay, J. A. Norgren, D. W. Anderson, and G. H. Simonson. Prepared for the Oregon State Water Resources Board, 1969, Appendix 1-10. 85 p, 3 fig, 10 tab, 2 map.

Descriptors: *Soils, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, *Infiltration, *Infiltration rates, *Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone. Identifiers: *Malheur River Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, *Erosion hazard, *Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are given for 2,879,400 acres of Malheur Drainage Basin located in southeastern Oregon. The Malheur Basin is predominantly hilly, strongly dissected terrain, underlain by old sediments and volcanic rock. Irrigated agriculture is concentrated on the broad terraces and flood plains bordering the Snake River and the lower reaches of the Malheur River and Willow Creek. Physiographic divisions include the low-elevation terraces and flood plains, grass-shrub uplands, small bottomland and basins at higher elevations, and forested uplands. Soils with poor drainage and alkali conditions are located primarily in Malheur and Harney counties, in the South Fork Malheur and Snake River sub-basins. Twelve soil or land characteristics are rated for irrigation suitability; the ratings used are excellent, good/fair, poor, very poor/nonirrigable. Twenty-four soils are unsuited for irrigation due to shallow and stony soils, or due to steep slopes. Soils subject to flooding are Bully, Barbutt, (Gi), Jett, (Ki), Powder, Riverwash, (Sm), Stanfield, Umapine, and Units 1, 3, 10, 15, and 43. Soils are analyzed according to runoff, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, and temperature limitation. Soils are interpreted with regard to water use and manage-

Field 2—WATER CYCLE

Group 2G—Water In Soils

ment. Detailed descriptions are given of the soil series, reconnaissance classification units, and mapping units. The information is based on the National Cooperative Soil Survey Program in Oregon. (Gentry-NC)
W77-06605

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, OWYHEE DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
B. B. Lovell, M. G. Lindsay, J. A. Norgren, D. W. Anderson, and G. H. Simonson.
Prepared for the Oregon State Water Resources Board, 1969, Appendix I-11. 72 p, 3 fig, 10 tab, 2 map.

Descriptors: *Soils, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, *Infiltration, *Infiltration rates, *Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management (Applied), Root zone.
Identifiers: *Owyhee Drainage Basin (OR), *Workability, *Available water-holding capacity (AWHC), *Shrink-swell potential, *Erosion hazard, *Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are given for 3,775,000 acres of the Owyhee Drainage Basin in southeast Oregon, more than 1 million acres of which are suitable for crops and improved pasture. The Owyhee Basin is gently sloping and rolling lava plateau terrain with precipitation between 8 and 12 inches annually, with a short growing season. Elevations range from 2,100 to 7,000 feet. The main irrigated area is along the Snake and lower Owyhee Rivers. Physiographic areas include alluvial bottomlands, nearly level closed basins or bottomlands, grass-shrub covered lava plateau uplands, and canyonlands and mountainous uplands. General locations of poorly drained and alkali soils are given. A guide is presented for irrigation suitability of soils, with ratings given to 12 soil or land characteristics; the ratings are excellent, good/fair, poor, very poor/nonirrigable. Sixteen soils are unsuited for irrigation due to steep slopes or shallow, stony soils; soils subject to occasional flooding and ponding are listed. Soils are analyzed according to runoff, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, and temperature limitations. Interpretations of soils are related to water use and management applicable to resource planning. Detailed descriptions of reconnaissance classification units, soil series and mapping units are given. The information used in the report is from the National Cooperative Soil Survey program in Oregon. (Gentry-NC)
W77-06606

SUPRAPERMAFROST WATER,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 2C.
W77-06630

DEPTH AND SEASONAL FLUCTUATIONS IN THE CONDITION OF THE GROUNDWATER OF THE AREA AROUND THE CITY OF GHENT (BELGIUM), (IN DUTCH),
Ghent Rijksuniversiteit (Belgium). Laboratorium voor Bodemfysica.
R. Hartmann.
Meded Fac Landbouwwet Rijksuniv Gent 38(2), p 281-293, 1973.

Descriptors: Seasonal, Depth, *Groundwater, *Sands, Rainfall, Evaporation, *Water table, *Water level fluctuations, *Soil texture, Water levels, Measurement.
Identifiers: *Belgium (City of Ghent).

The fluctuations of the ground water-table in sandy soils of this area as results of the interaction between rainfall and evaporation, were measured during a period of 5 yr. The measurements were carried out for 4 different drainage classes. For the sandy soils of Ghent the lowest mean annual level is higher and the highest mean annual level is lower in comparison with sandy soils of the Campine in the province Antwerp. The difference in the fluctuation is due to the finer texture of the sandy soil around Ghent. The average depths of the high and low water-levels, which can be deduced from morphological properties of the soil profile, correspond to the standards of the drainage classes derived from the watertable fluctuations observed during 5 consecutive years.
W77-06681

LAND FORMING SYSTEMS TO IMPROVE WATER USE EFFICIENCY,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-06761

SMOOTHING DATA WITH CUBIC SPLINES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 7C.
W77-06831

A METHOD OF EVALUATING A FIELD WATER CAPACITY USING PF-3, (IN FRENCH),
Institut National de la Recherche Agronomique, Toulouse (France). Station d'Agronomie.
C. Dancette, and C. Maertens.
Bull Assoc Fr Etude Sol 3, p 165-172, 1974.

Descriptors: *Field capacity, *Retention, *Moisture content, *Soil moisture, Agriculture, Alluvium, Methodology.

A method allowing the approximate determination of field capacity, using only the determination of water retention of pF (a measure of soil humidity)=3, is described. In alluvial soils, the accuracy of this method appears sufficient to satisfy the current needs of agriculture.—Copyright 1976, Biological Abstracts, Inc.
W77-06844

POTASSIUM IN AN ARID LOESSIAL SOIL: CHANGES IN AVAILABILITY AS RELATED TO CROPPING AND FERTILIZATION,
Utah State Univ., Logan. Dept. of Soil and Meteorology.
For primary bibliographic entry see Field 3F.
W77-06870

BONDING OF CALCIUM AND POTASSIUM BY VERMICULITE AND KAOLINITE CLAYS AS AFFECTED BY H-CLAY ADDITION,
Ohio State Univ., Columbus. Dept. of Agronomy.
A. S. Baweja, and E. O. McLean.
Soil Science Society of America Proceedings, Vol. 39, No. 1, p 48-50, January-February 1975. 2 fig, 1 tab, 16 ref.

Descriptors: *Kaolinite, *Calcium, *Potassium, Soils, Soil investigations, *Clays, *Bonding.
Identifiers: *Vermiculite.

The less than 2 micro-m fraction of Libby vermiculite and Peerless kaolinite was separated and H-saturated by resin treatment. The H-clay suspensions were immediately saturated with either Ca or K by addition of the respective hydroxides. Six reciprocal Ca-K saturations of each clay were prepared by mixing the Ca- and K-clays in appropriate amounts. Increments of H-clay were added to lower the base saturation and thereby inactivate the pH-dependent charges.

Radioisotopes, ⁴⁵Ca and ⁸⁶Rb, were used as tracers for Ca and K, respectively. Two-phase Donnan-type systems were prepared and equilibrated for 23 days. Radioactivity in both phases was then assayed and the amounts of Ca and K retained in the suspension phases of the two clay systems computed. The pH-dependent fraction of the total CEC was 6.9 and 18.0% for vermiculite and kaolinite, respectively. Additions of H-clay increased the bonding of both Ca and K as indicated by greater clay-phase retention. However, maximum retention of the cations at all Ca-K saturation ratios did not occur when the amounts of H-clay added equaled the pH-dependent charge fraction of the clay as had occurred with bentonite and illite. (Skogerboe-Colo St)
W77-06872

FATE OF NITROGEN AND PHOSPHORUS IN SOILS UNDER SEPTIC TANK WASTE DISPOSAL FIELDS,
Agricultural Research Service, Beltsville, Md. Biological Waste Management Lab.; Agricultural Research Service, Beltsville, Md. Soil Nitrogen Lab.; and Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
For primary bibliographic entry see Field 5B.
W77-06914

ACCUMULATION OF HEAVY METALS IN SOILS FROM EXTENDED WASTE WATER IRRIGATION,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-07049

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: I. GENERAL INFORMATION ON SEWAGE FARM, SOIL, AND TREATMENT RESULTS,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5G.
W77-07052

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: II. FRACTIONATION OF ACCUMULATED PHOSPHATES,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5B.
W77-07053

SOLUBILITY AND PLANT UPTAKE OF CADMIUM IN SOILS AMENDED WITH CADMIUM AND SEWAGE SLUDGE,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-07055

UNDERFLOW FROM SLUDGE-IRRIGATED CROPLAND,
Springfield Sanitary District, Ill.
For primary bibliographic entry see Field 5B.
W77-07056

2H. Lakes

MIXING AND CIRCULATION OF LAKES AND RESERVOIRS WITH AIR PLUMES,
New Hampshire Univ. Durham. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W77-06633

MIXING IN UPPER LAYER OF A LAKE DURING HEATING CYCLE,
Institute of Oceanographic Sciences, Wormley (England).

S. A. Thorpe, and A. J. Hall.
Nature, Vol. 265, No. 5596, p 719-722, February 24, 1977. 5 fig, 5 ref.

Descriptors: *Mixing, *Lakes, *Water temperature, Waves(Water), Winds, On-site investigations, Measurement, Surveys, Instrumentation, Data processing, Stratification, Stability, Heat, Heat transfer, Heating, Temperature, Currents(Water), Internal waves, Freshwater, Limnology.
Identifiers: Billows.

Little is yet known about the structure of the upper 'mixing' layer of the ocean below the zone of direct surface wave influence. Some measurements were reported of the temperature field in the mixing layer of a freshwater lake during the heating cycle. The measurements demonstrate some of the processes which may be important. The temperature field is found to be isotropic at scales less than about 60 cm, but the effect of stratification becomes important at larger scales, reducing the vertical correlations in comparison with the horizontal. The spatial evolution of structures is dominated by the shear, as appropriate in the low Richardson number region. Examination of the stability of the mean velocity and density profiles showed that Kelvin-Helmholtz instability may be expected, leading to billows with wavelengths of about 60 m, and corresponding to fluctuation scales observed in the temperature records. Similar fluctuations were seen in the nocturnal atmospheric boundary layer. (Sims-ISWS) W77-06649

THE OBSERVED WINTER CIRCULATION OF LAKE ONTARIO,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
R. L. Pickett.
Journal of Physical Oceanography, Vol. 7, No. 1, p 152-156, January 1977. 7 fig, 1 tab, 8 ref.

Descriptors: *Lake Ontario, *Great Lakes, *Winter, *Circulation, Bathymetry, Lakes, Mathematical models, Currents, Temperature, Numerical analysis.
Identifiers: *Lake circulation, *Winter circulation, Lake currents, Gyre pattern, Whole-lake studies.

Lake Ontario's winter circulation had not been observed prior to 1972 because harsh weather and lake ice discouraged the extension of observations past autumn. Previous whole-lake studies were made via surface drift bottles or moored current meters. Hydraulic circulation from inflow-outflow is always small, and thermally driven flow in nearly isothermal water must be small. Therefore, winter currents should be wind driven. Previous wind-driven patterns for Lake Ontario's winter circulation were based on homogeneous, vertically integrated numerical models. The models included both friction and the earth's rotation in transport for a given wind. Another steady-state model predicted 2 counter-rotating gyres induced by the bowl-shaped bathymetry. Transport was with the wind nearshore, and against the wind offshore. A third time-dependent model showed only a one-gyre pattern rotating in the direction of the applied wind curl. Other researchers felt that the dominant pattern depended on the relative strength of the bathymetric-wind curl effects. During the International Field Year for the Great Lakes in 1972-73, the winter circulation of Lake Ontario was finally observed. Data suggested that currents and temperatures are nearly constant with depth, and that the lake-wide mean circulation pattern consists of either one counterclockwise or two counter-rotating gyres. (Roberts-ISWS) W77-06655

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY,
Bendix Aerospace Systems Div. Ann Arbor, Mich.

For primary bibliographic entry see Field 5A.
W77-06665

MEASUREMENTS OF PLANKTONIC BIOMASS IN A RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W77-06679

LIMNOLOGICAL AND PLANKTONIC STUDIES IN THE WATERTON LAKES, ALBERTA,
Canadian Wildlife Service, Edmonton (Alberta).
For primary bibliographic entry see Field 5C.
W77-06680

MEANS FOR PROTECTING THE DRINKING WATER QUALITY OF LAKE GEORGE, NEW YORK,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5G.
W77-06682

STRATIFICATION OF KINETIC ORIGIN AND ITS BIOLOGICAL CONSEQUENCES IN A NEOTROPICAL MAN-MADE LAKE,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
Z. M. Gliwicz.
Ekologia Polska, Vol. 24, No. 2, p. 197-209, 1976. 6 fig., 1 tab., 22 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Subtropic, *Cycling nutrients, *Thermocline, Productivity, Metalimnion, Oxygen sag, Lakes.
Identifiers: *Madden Lake(Panama Canal Zone).

In subtropical Madden Lake in the Panama Canal Zone the density gradient prevents a substantial portions of the nutrients from cycling within the reservoir. The concentration of nutrients in the euphotic zone induces a steady-state high standing crop and phytoplankton production, with only the more difficult oxidizable organic matter falling to the deeper layers where it is quickly carried away by the colder Rio Chagres water. Madden Lake has a strong thermal stratification of up to 5°C differentiation between surface and bottom layers which results from the cool river influents filling the bottom layers of the lake. The steep gradients of water density in the metalimnion correspond to a negative retrograde minima in oxygen depth profiles. Both the steepness and the depth of the density gradient depend on the reach of vertical mixing as well as on the temperature and volume of river influents. Oxygen-saturated river water moving slowly below the metalimnion along the former river beds reduces oxygen deficiency in the hypolimnion; and when the density gradient is sufficiently steep, sinking of organic matter is slowed in the metalimnion producing oxygen minima due to the high respiration intensity of the entire plankton community in the thermocline layer. (Auen-Wisconsin). W77-06683

A GENERAL MODEL OF MICROBIAL GROWTH AND DECOMPOSITION IN AQUATIC ECOSYSTEMS,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5C.
W77-06684

DYNAMICS OF PHYTOPLANKTON BIOMASS IN TWO LAKES OF DIFFERENT LIMNOLOGICAL CHARACTER,
Instytut Przyrodniczych Podstaw, Lubin (Poland). Produkcji Roslinnej AR.
For primary bibliographic entry see Field 5C.
W77-06685

NUTRIENT REMOVAL AND SLUDGE DISPOSAL WITHIN SEPTIC SYSTEMS-PHASE III,
Rensselaer Polytechnic Inst., Troy, N. Y. Fresh Water Inst.
For primary bibliographic entry see Field 5D.
W77-06686

LAKE CURRENTS AND TEMPERATURES NEAR THE WESTERN SHORE OF LAKE MICHIGAN,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
G. K. Sato, and C. H. Mortimer.
Special Report No. 22, March 1975. 322 p, 218 fig, 6 tab, 56 ref. AEC AT(11-1)-2158.

Descriptors: *Lake Michigan, *Currents(Water), Winds, *Water temperature, Temperature, Water circulation, Current meters, On-site data collections, Instrumentation, *Thermal pollution, Powerplants, Data processing, Internal waves, Upwelling, Stratification, Lakes, Limnology, *Path of pollutants.

The objective was a description of the variability of nearshore current regimes and temperature fields in the neighborhood of the Wisconsin Electric Company's fossil-fueled, lake-cooled power plant at Oak Creek, Wisconsin. Attention was paid, not to plume geometry and behavior in the near field (except for a study of sinking plumes in winter), but to the ambient lake motions into which the plumes are being discharged. An array of recording current meters and thermographs was moored in an area of approximately 15 km alongshore, and the same distance offshore, to provide 10-minute readings of current speed, current direction, and temperature. The currents in the coastal region proved to be mainly responsive to the direction of the wind. Vector frequency diagrams and progressive vector diagrams for monthly or shorter intervals confirmed the predominantly shore-parallel current patterns with greater flow tendency towards SSE. Current speeds were variable, monthly means were commonly as low as 5 cm/sec, but such means included episodes of very weak currents (less than 4 cm/sec), which in total may have occupied half the month. The current speeds in the other half ranged from 4 to over 30 cm/sec. Before stratification had become established in June, temperature records showed steady increases and no large variations, but after stratification, the effects of upwelling and downwelling events became apparent, associated with north-going and south-going currents, respectively. The onset of upwelling and downwelling was signalled by a respective drop or rise in temperature, often sudden and common-associated with a reversal in current flow. (See also W75-11190) (Sims-ISWS) W77-06687

THE MINING FAUNA IN FOUR MACROPHYTE SPECIES IN MIKOLAJSKIE LAKE,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
For primary bibliographic entry see Field 5C.
W77-06688

LAKE RESTORATION BY BOTTOM WATER SIPHONING (IN GERMAN),
Eidgenössische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewässerschutz, Kastanbaum (Switzerland). Marine Research Lab.
For primary bibliographic entry see Field 5G.
W77-06689

THE SHARE OF ALGAE WITH DIFFERENT DIMENSIONS IN THE PLANKTON OF TWO LAKES OF DIFFERENT TROPHIC CHARACTER IN THE ANNUAL CYCLE,
Instytut Przyrodniczych Podstaw, Lubin (Poland). Produkcji Roslinnej AR.

Field 2—WATER CYCLE

Group 2H—Lakes

For primary bibliographic entry see Field 5C.
W77-06692

PRESENTING TRENDS IN LAKE EUTROPHICATION,
CBA Engineering Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5C.
W77-06693

A STUDY ON THE ROLE OF HERBIVOROUS ZOOPLANKTON COMMUNITY AS PRIMARY CONSUMERS OF PHYTOPLANKTON IN DUTCH LAKES,
For primary bibliographic entry see Field 5C.
W77-06695

SOME EFFECTS ON INTEGRAL PHOTOSYNTHESIS OF ARTIFICIAL CIRCULATION OF PHYTOPLANKTON THROUGH LIGHT GRADIENTS,
For primary bibliographic entry see Field 5C.
W77-06696

THE USE OF REMOTE SENSING TO DETECT HOW WIND INFLUENCES PLANKTONIC BLUE-GREEN ALGAL DISTRIBUTION,
For primary bibliographic entry see Field 5C.
W77-06697

THE HISTORIC AND PRESENT RELATIONSHIPS BETWEEN PHYTOPLANKTON, LIMITING NUTRIENTS, AND SEDIMENT-WATER GEOCHEMICAL PROCESSES IN SELECTED MAINE LAKES,
Maine Univ. at Orono. Land and Water Resources Inst.
For primary bibliographic entry see Field 5C.
W77-06741

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN I. QUANTITATIVE RELATIONS AND QUALITATIVE COMPOSITION OF THE BOTTOM FAUNA OF THE KONIN LAKES COMPLEX, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06749

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN II. CHANGES IN TIME OF BOTTOM FAUNA, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06750

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN III. AN EFFORT TO EXPLAIN THE CAUSES AND RESULTS OF CHANGES IN THE BOTTOM FAUNA OF LAKES AS INFLUENCED BY THE INFLOW OF HEATED WATERS, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06751

PRIMARY AND SECONDARY PRODUCTION OF PLANKTON IN HEATED LAKES, (IN POLISH),
Polish Academy of Sciences, Warsaw. Inst. of Ecology; and Polish Academy of Sciences, Warsaw, Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.

W77-06752

THE INFLUENCE OF HEATED EFFLUENT WATERS ON THE WATER CHEMISM OF KONIN LAKES, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06753

OCCURRENCE AND GROWTH OF DREISSENA POLYMORPHA PALL. IN LAKES INCLUDED IN A COOLING SYSTEM, (IN POLISH),
Polish Academy of Sciences, Warsaw. Inst. of Ecology; and Polish Academy of Sciences, Warsaw, Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W77-06754

LONG-TERM CHANGES OF THE PELAGIC PRIMARY PRODUCTION IN HEATED LAKES, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06755

THE INFLUENCE OF HEATED EFFLUENT WATERS ON THE THERMAL-OXYGEN RELATIONS AND WATER TRANSPARENCY IN THE KONIN LAKES COMPLEX, (IN POLISH),
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06756

CHANGES IN THE STRUCTURE OF PHYTOPLANKTON DURING THE FIRST YEARS OF EXISTENCE OF THE DERPAP STORAGE RESERVOIR, (IN SERBO-CROATIAN),
Institute for Biological Research, Belgrade (Yugoslavia).
D. Milovanovic.
Arh Biol Nauka 15(1/2), p 75-84, 1973.

Descriptors: *Phytoplankton, *Reservoirs, Habitats, *Environmental effects, Hydroelectric plants, Diatoms, Chlorophyta.
Identifiers: Microcystis aeruginosa, *Yugoslavia(Derdap Reservoir).

The qualitative and quantitative changes in the structure of phytoplankton in a water medium modified morphometrically and hydrologically by the construction of the Derdap water power system (Yugoslavia) were analyzed in detail. The phytoplankton has retained its original autochthonous biocenotic composition of a Diatomae-Chlorophyceae type along the longitudinal profile of the reservoir. New components of the phytoplankton community were registered during 2 summers. An ecologically and trophically characteristic species Microcystis aeruginosa, was abundant.—Copyright 1976, Biological Abstracts, Inc.
W77-06786

EXPERIMENT WITH A MULTIPOINT SYSTEM FOR JUDGING CARP FATTENING PONDS, (IN RUSSIAN),
Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).
G. I. Shpet, and N. N. Nharitonova.
Gidrobiol Zh 11(2), p 51-59, 1975.

Descriptors: *Productivity, *Carp, *Ponds, *Freshwater fish, Dimensions, Flow, Depth, Hydrogeology, Water chemistry, Climatic zones, Fish.
Identifiers: Productivity indexes, Water exchange, Ukrainian-SSR, USSR.

A multipoint system is suggested for determination of natural fish productivity from 18 indices taking into account the pond dimensions, water exchange, depths, ground conditions, hydrochemistry and other factors. Depending on the optimum, medium or minimum value of each index, the respective percentage is added to or subtracted from the initial value. This yields a value of natural fish productivity. The results of this method of examination in 17 ponds in 3 climatic zones of the Ukrainian S.S.R. (USSR) are presented.—Copyright 1976, Biological Abstracts, Inc.
W77-06798

LAKE ST. CLAIR HYDROLOGIC TRANSFER FACTORS.
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
F. H. Quinn.
NOAA Technical Memorandum ERL GLERL-10, July 1976. 19 p., 1 fig, 16 tab, 3 ref.

Descriptors: Hydrology, *Lakes, Water resources, *Precipitation(Atmospheric), *Evaporation, *Runoff, *Storage, Rainfall-runoff relationships.
Identifiers: *Lake St. Clair, *Transfer factors(Hydrologic).

Monthly hydrologic transfer factors were developed for Lake St. Clair for the period 1950-1974 to aid in the comparison and coordination of St. Clair and Detroit River monthly flows. The transfer factor is defined as the sum of the monthly precipitation and runoff minus the evaporation and change in storage. Each of the hydrologic constituents were determined independently from available data. (NOAA)
W77-06879

LAKE ONTARIO ATLAS: SURFACE WAVES,
New York Sea Grant Inst., Albany.
G. E. Myer.
New York Sea Grant Institute Lake Ontario Atlas Monograph No. NYSSGP-OA-77-004, 1977. 109 p., 56 fig, 64 ref.

Descriptors: *Lake Ontario, *Lakes, *Water levels, Seiches, Gravity waves, Wind tides, Surges, Tides, Data collection.
Identifiers: Atlases, Surface waves, Astronomical tides.

An analysis of gravity waves, seiche, wind tides, and long-term variations in lake level is provided. A computerized analysis details the dynamics of each effect. Specific storm effects are analyzed and an example of hindcasting of wind velocity v, wave height is explained. Although records of water levels through 1974 indicate that the average lake surface elevation has varied as much as 2 m, locally the variations in water level have been greater than this. Some of the changes have been aperiodic, others have followed a long period, and many were somewhat periodic but with short periods. This monograph has been written as a summary of much of what is now known about these locally observed time dependent water level variations in Lake Ontario. (NOAA)
W77-06884

IRON-RICH RHYTHMICALLY LAMINATED SEDIMENTS IN LAKE OF THE CLOUDS, NORTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. Limnological Research Center.
For primary bibliographic entry see Field 2J.
W77-06901

A DEVICE FOR MEASURING SEEPAGE FLUX IN LAKES AND ESTUARIES,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.

For primary bibliographic entry see Field 7B.
W77-06903

HYDRAULICS OF SHEET FLOW IN WETLANDS.
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-06929

IDENTITY, ORIGIN AND DEVELOPMENT OF OFF-FLAVORS IN GREAT LAKES ANADROMOUS FISH.
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5A.
W77-06931

NUMERICAL MODELS OF WIND-DRIVEN CIRCULATION IN LAKES.
Geological Survey, Menlo Park, Calif. Water Resources Div.
R. T. Cheng, T. M. Powell, and T. M. Dillon.
Applied Mathematical Modelling, Vol 1, p 141-159, December 1976. 11 fig, 1 tab, 99 ref.

Descriptors: *Lakes, *Water circulation, *Winds, *Mathematical models, Numerical analysis, Equations, Finite element analysis, Analytical techniques, Hydrodynamics, Turbulence, Mixing, Shallow water, Gravity waves, Evaluation.
Identifiers: *Three-dimensional models, *Ekman-type models.

The state-of-the-art of numerical modelling of large-scale wind-driven circulation in lakes is presented. The governing equations which describe this motion are discussed along with the appropriate numerical techniques necessary to solve them in lakes. The numerical models are categorized into three large primary groups: the layered models, the Ekman-type models, and the other three-dimensional models. Discussions and comparison of models are given and future research directions are suggested. (Woodard-USGS)
W77-06958

HYDROCHEMISTRY OF THE LAKE MAGADI BASIN, KENYA.
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 2K.
W77-06967

MONROE RESERVOIR, INDIANA, PART I: HYDROLOGIC CIRCULATION, SEDIMENTATION, AND WATER CHEMISTRY PART II: NUTRIENT RELATIONS.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W77-06982

21. Water In Plants

INFLUENCE OF GRADIENT ON THE DISTRIBUTION OF FISHES IN CONOWINGO CREEK, MARYLAND AND PENNSYLVANIA.
Ichthyological Associates, Inc., Durnmore, Pa.
C. H. Hocutt, and J. R. Stauffer.
Chesapeake Science, Vol. 16, No. 1, p. 143-147, 1975. 2 tab, 3 fig, 17 ref.

Descriptors: *Streams, *Gradients(Streams), Flow, *Gradation, *Distribution, *Distribution patterns, *Spatial distribution, *Fish, *Environmental effects, Freshwater fish, Analytical techniques, Sampling, Stream fisheries, Suckers, Minnows.
Identifiers: *Conowingo Creek(Md-Pa), *Rhinichthys atratulus*, *Notropis cornutus*,

Catostomus commersoni, *Exoglossum maxillingua*.

Twenty-seven fish species were collected from Conowingo Creek at eleven stations during the summer, 1970. Species most abundant were *Rhinichthys atratulus*, *Notropis cornutus*, *Exoglossum maxillingua*, *Semotilus atromaculatus* and *Catostomus commersoni*. A Spearman's rank correlation coefficient matrix was calculated for biological and physical parameters. Distribution of fishes appeared related to width and depth of the stream, but was most influenced by gradient. (Katz)
W77-06635

SOME SIGNIFICANT REGULARITIES IN PLANT HYDROADAPTATION, (IN RUSSIAN).
For primary bibliographic entry see Field 3B.
W77-06774

ECOLOGICAL DATA ON CONTINENTAL AQUATIC VEGETATION, (IN SPANISH).
Universidad Complutense de Madrid (Spain). Dept. of Botany and Plant Physiology.
S. Rivas-Martinez.
An Inst Bot A J Cavanilles 32(1), p 199-205, 1975.

Descriptors: *Ecotypes, *Aquatic habitats, *Aquatic plants, *Vegetation, *Aquatic environment, Habitats, Surface waters, Bodies of water, Environment, Lakes, Rivers, Ponds.
Identifiers: Limnobiocenoses, Plant associations.

The phytosociological groups of motile and fixed vegetation which inhabit the limnobiocenoses of lakes, rivers, ponds and other continental aquatic environments are reviewed. Understanding these associations is considered important to their preservation.--Copyright 1976, Biological Abstracts, Inc.
W77-06784

FOAM AND FILM OF FRESH WATERS AS AN ECOLOGICAL NICHE OF AQUATIC HYPHOMYCETES, (IN RUSSIAN).
Akademiya Nauk URSR, Kiev. Instytut Botaniki.
I. A. Dudka, and V. I. Beregovaya.
Gidrobiol Zh 11(4), p 80-86, 1975.

Descriptors: *Freshwater, *Aquatic fungi, *Organic compounds, *Dissolved solids, *Suspended solids, *Productivity, Ecology, Proteins, Films, Foaming.
Identifiers: Conidia, Organic detritus, *Foam, *Hyphomycetes.

The natural foam and film of freshwaters, which are composed of a concentration of surfaceactive organic substances and contain solid mineral particles, and dissolved suspended organic compounds, form a complex 3-phase system. The presence in them of high concentrations of protein substances, sources of C, phosphates, Nitrates, Nitrites, and a vast quantity of organic animal and vegetable detritus, creates conditions which preserve the viability of Conidia of aquatic hyphomycetes and permit their growth on appropriate substrates (fragments of the leaves of trees and shrubs). The surface foam and film enable the conidia to be spread by waterfowl, wind and water current. The foam and film are regarded as an ecological niche of aquatic hyphomycetes.--Copyright 1976, Biological Abstracts, Inc.
W77-06787

INDICATOR VALUES OF VASCULAR PLANTS IN CENTRAL EUROPE, (IN GERMAN).
Goettingen Univ. (West Germany). Systematisch-Geobotanisches Institut.
H. Ellenberg.
Scr Geobot 9, p 1-97, 1974.

Descriptors: *Bioindicators, *Climates, Light, Temperature, Distribution, Soil moisture, Nitrogen, Acidity, *Soil chemical properties, Salinity, Heavy metals, *Ecology, Plant physiology, *Europe.
Identifiers: *Vascular plants.

A comprehensive synopsis of the indicator values of about 200 spp. (or microspecies) of vascular plants in west central Europe is given. The so-called ecological behavior of the plants is briefly expressed by figures representing 9 degrees of behavior with regard to the main environment factors. Three figures relate to climatic factors, light, temperature and continentality of the distribution range. The following 3 figures relate to soil factors, moisture, acidity and N supply. Salinity and concentration of heavy metals are discussed. In addition to the ecological behavior, morphological, anatomical and phytosociological information is given.--Copyright 1976, Biological Abstracts, Inc.
W77-06803

DEPENDENCE OF WATER ABSORPTION BY THE CELL WALLS OF PLANT LEAVES ON THE VOLUME OF THE FREE SPACE, (IN RUSSIAN).
Kazan Inst. of Biology (USSR).
L. A. Shishkina, and A. M. Alekseev.
Fiziol Biokhim Kul'T Rast 7(3), p 323-325, 1975.

Descriptors: *Absorption, *Cytological studies, Plant morphology, *Beans, *Wheat, Leaves.
Identifiers: *Millet, *Leaf mesophyll.

The rate of water movement into the cell walls of the leaf mesophyll, during the exclusion of transpiration, was studied in beans, spring wheat, and millet. This index was directly dependent ($r=+0.97$) on the volume of cellular free space, and was greatest in spring wheat and least in beans. This confirms the role of the free space in the regulation of water metabolism in plants, and thus the existence of a unified hydrostatic system.
W77-06827

2J. Erosion and Sedimentation

PARTICLE CHARACTERISTICS AND DISPERSAL PATTERNS OF SUGAR CANE WASTES IN SELECTED RIVERS AND ESTUARIES OF PUERTO RICO.
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W77-06632

NILE CONE: LATE QUATERNARY STRATIGRAPHY AND SEDIMENT DISPERSAL.
Smithsonian Institution, Washington, D. C. Div. of Sedimentology.
For primary bibliographic entry see Field 2L.
W77-06650

MONITORING THE MARINE ENVIRONMENT THROUGH SEDIMENTATION.
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 2L.
W77-06651

SEDIMENT YIELD PREDICTION BASED ON WATERSHED HYDROLOGY.
Agricultural Research Service, Temple, Tex.
For primary bibliographic entry see Field 4D.
W77-06656

CURRENT METHODS USED IN THE SOIL CONSERVATION SERVICE TO ESTIMATE SEDIMENT YIELD.
Soil Conservation Service, Fort Worth, Tex.

Field 2—WATER CYCLE

Group 2J—Erosion and Sedimentation

For primary bibliographic entry see Field 4D.
W77-06657

COMPUTING EOLIAN SAND TRANSPORT FROM ROUTINE WEATHER DATA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.; and Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
For primary bibliographic entry see Field 2L.
W77-06669

AN EXECUTIVE SUMMARY OF THREE EPA DEMONSTRATION PROGRAMS IN EROSION AND SEDIMENT CONTROL,
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 5G.
W77-06671

DEBRIS BASINS FOR CONTROL OF SURFACE MINE SEDIMENTATION,
Kentucky Dept. for Natural Resources and Conservation, Frankfort. Office of Planning and Research.
For primary bibliographic entry see Field 5G.
W77-06672

THE HISTORIC AND PRESENT RELATIONSHIPS BETWEEN PHYTOPLANKTON, LIMITING NUTRIENTS, AND SEDIMENT-WATER GEOCHEMICAL PROCESSES IN SELECTED MAINE LAKES,
Maine Univ. at Orono. Land and Water Resources Inst.
For primary bibliographic entry see Field 5C.
W77-06741

PARTIAL EXTRACTION OF METALS FROM AQUATIC SEDIMENTS,
Geological Survey, Albany, N.Y. Central Lab.
For primary bibliographic entry see Field 5A.
W77-06781

A SELF-CONTAINED FACILITY FOR ANALYZING NEAR-BOTTOM FLOW AND ASSOCIATED SEDIMENT TRANSPORT,
Chicago Univ., Ill. Dept. of the Geophysical Sciences.
For primary bibliographic entry see Field 2L.
W77-06874

A TEST PARTICLE DISPERSION STUDY IN MASSACHUSETTS BAY,
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 2L.
W77-06880

LITTORAL DRIFT ESTIMATES ALONG THE COASTLINE OF FLORIDA,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2L.
W77-06882

EFFECTS OF ENGINEERING ACTIVITIES ON THE ECOLOGY OF PISMO CLAMS,
Moss Landing Marine Labs., Calif.
For primary bibliographic entry see Field 5C.
W77-06886

INTERSTITIAL WATER CHEMISTRY OF ANOXIC LONG ISLAND SOUND SEDIMENTS. I. DISSOLVED GASES,
Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-06900

IRON-RICH RHYTHMICALLY LAMINATED SEDIMENTS IN LAKE OF THE CLOUDS, NORTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. Limnological Research Center.
R. S. Anthony.
Limnology and Oceanography, Vol 22, No 1, p 45-54, January 1977. 6 fig, 4 tab, 21 ref. NSF GB-7163.

Descriptors: *Sediments, *Lakes, *Varves, *Minnesota, Surveys, On-site investigations, Laboratory tests, Chemical analysis, Chemicals, Iron, Iron oxides, Manganese, Core logging, Cores, Annual, Annual turnover, Limnology.
Identifiers: *Laminated sediments, *Lake in the Clouds(Minn).

Sediments from the deepest part of Lake of the Clouds (31 m) are rhythmically laminated throughout all but the basal part of the column. The laminations can be correlated with events in the lake during the annual cycle. Ferrous iron (maximum 620 ppm) accumulates in a layer of water about 2 m thick in the deepest part of the lake. The laminations form in the sediments only where overlain by this stagnant iron-rich water. The light-colored portion of the couplet presumably forms from iron oxides precipitated from partially oxygenated bottom water during fall and spring overturns, and the dark layer seems to form from organic remains that settle out during summer. Chemical analysis and electron-microprobe studies revealed a much higher concentration of iron and manganese in the light layers than in the dark. Vivianite and probably limonite occur extensively in nodules throughout the core. Siderite was identified by X-ray diffraction. Numerous orange spherical aggregates occur in the light layers. An iron and manganese profile of the sediment column suggests that the most distinct laminae are found where the iron content of the sediment is at least 4%. (Sims-ISWS)
W77-06901

PARTICULATE TRANSPORT OF RADIONUCLIDES 14C AND 55FE TO DEEP WATERS IN THE PACIFIC OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5B.
W77-06902

INCIPIENT SEDIMENT MOTION IN ENTRANCES WITH SHELL BEDS,
Florida Univ., Gainesville. Dept. of Civil Engineering; and Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2L.
W77-06930

CHARACTERISTICS OF WATER FLOW AT THE NORTH END OF THE WASSAW BARRIER ISLAND COMPLEX. WASSAW ISLAND EROSION STUDY, PART II,
Georgia Marine Science Center, Savannah.
G. F. Oertel.
Georgia Marine Science Center Sea Grant Technical Report Series No. 77-2, (1977) 14 p, 7 fig, 3 ref. SG-04-5-158-4.

Descriptors: *Inlets(Waterways), *Sediment transport, *Erosion, *Sedimentation, Georgia, Barrier islands, Ocean currents, Water transfer.
Identifiers: Water currents, Sea Grant Program.

This report supplements an earlier report on the 'Sedimentary framework of a channel margin shoal of an ebb delta, Wassaw Sound, Georgia'. The purpose of this report is to produce an overview of water currents that may affect the sediment carpet described in the earlier report. Water flow recorded at four different stations around the marginal shoal. At each station, data was recorded for two tidal cycles (approximately 25 hours) at six

minute intervals. In all, approximately 2,000 data points were collected.
W77-06939

SAND STABILIZATION ON THE DUNES, BEACH AND SHOREFACE OF A HISTORICALLY ERODING BARRIER ISLAND. WASSAW ISLAND EROSION STUDY, PART III,
Georgia Marine Science Center, Savannah.
For primary bibliographic entry see Field 8G.
W77-06940

CHANGING NEEDS AND OPPORTUNITIES IN THE SEDIMENT FIELD,
Geological Survey, Baltimore, Md. Water Resources Div.
M. G. Wolman.
Water Resources Research, Vol 13, No 1, p 50-54, February 1977. 21 ref.

Descriptors: *Sedimentation, *Erosion, *Sediment transport, *Sediment yield, Reviews, Evaluation, Model studies, Hydrologic properties, Hydrologic data, Environmental effects.

Information on the processes of erosion and sedimentation, while sometimes sufficient for gross estimates of yield, remains inadequate for modern environmental management. Little is known about sequential processes involved in the systems of erosion and sedimentation, and practice and theory require attention to unsteady or discontinuous erosion and transportation as sediments move from source through channel systems with intermittent periods of storage. While climatic and hydrologic variations markedly affect yield, transport and deposition thresholds of erosion of cohesive materials and sequences of such effects remain unclear. The highly variable temporal and spatial character of erosion and sedimentation processes must be emphasized in the predictive exercise of environmental impact assessment. Validation or testing of the predictive capacity of our current knowledge can only be achieved by field observation. This does not imply massive data collection programs but rather an integration of model building, laboratory study, and continuity of study in carefully selected field areas. (Woodard-USGS)
W77-06964

DELAWARE RIVER: EVIDENCE FOR ITS FORMER EXTENSION TO WILMINGTON SUBMARINE CANYON,
Geological Survey, Woods Hole, Mass. Geologic Div.
For primary bibliographic entry see Field 2E.
W77-06966

SEDIMENT DISCHARGE FROM AN AREA OF HIGHWAY CONSTRUCTION, APPLEMAN RUN BASIN, COLUMBIA COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, Pa. Water Resources Div.
For primary bibliographic entry see Field 4C.
W77-06969

DIMINUTION RATIOS FOR PLANNING CONSTRUCTION-AREA SEDIMENT CONTROLS,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 4D.
W77-06980

MONROE RESERVOIR, INDIANA, PART I: HYDROLOGIC CIRCULATION, SEDIMENTATION, AND WATER CHEMISTRY PART II: NUTRIENT RELATIONS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W77-06982

SEDIMENTS AND WATER QUALITY OF URBAN STORM WATER.
Middlesex Polytechnic, London (England).
For primary bibliographic entry see Field 5B.
W77-06984

2K. Chemical Processes

MINERAL CONTENT OF SELECTED GEOTHERMAL WATERS.
Nevada Univ. System, Las Vegas. Water Resources Center.
For primary bibliographic entry see Field 3E.
W77-06667

THE DISTRIBUTION OF NATURAL AND ANTHROPOGENIC ELEMENTS AND COMPOUNDS IN PRECIPITATION ACROSS THE U.S.; THEORY AND QUANTITATIVE MODELS.
North Carolina Univ., Chapel Hill. Dept. of Botany.
For primary bibliographic entry see Field 2B.
W77-06675

METHANE-DERIVED CARBONATE CEMENTS IN BARRIER AND BEACH SANDS OF A SUBTROPICAL DELTA COMPLEX.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W77-06677

WATER CHEMISTRY AND WATER QUALITY.
Uppsala Univ. (Sweden). Dept. of Physical Geography; and Uppsala Univ. (Sweden). Div. of Hydrology.
For primary bibliographic entry see Field 5A.
W77-06778

PARTIAL EXTRACTION OF METALS FROM AQUATIC SEDIMENTS.
Geological Survey, Albany, N.Y. Central Lab.
For primary bibliographic entry see Field 5A.
W77-06781

BONDING OF CALCIUM AND POTASSIUM BY VERMICULITE AND KAOLINITE CLAYS AS AFFECTED BY H-CLAY ADDITION.
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-06872

HYDROCHEMISTRY OF THE LAKE MAGADI BASIN, KENYA.
Geological Survey, Reston, Va. Water Resources Div.
B. F. Jones, H. P. Eugster, and S. L. Rettig.
Geochimica et Cosmochimica Acta, Vol 41, p 53-72, 1977. 7 fig, 4 tab, 24 ref.

Descriptors: *Water chemistry, *Lakes, *Brines, *Inflow, *Africa, Surface-groundwater relationships, Sampling, Boreholes, Evaporation, Alkaline water, Adsorption, Chemical precipitation, Salts, Springs, Chemical reactions, Pollutant identification.
Identifiers: *Kenya(Rift Valley), *Lake Magadi basin(Kenya).

Water samples from the Lake Magadi area, Kenya, range from dilute inflow (<0.1 g/kg dissolved solids) to very concentrated brines (>300 g/kg dissolved solids). Five distinct hydrologic stages can be recognized in the evolution of the water compositions: dilute streamflow, dilute ground water, saline ground water (or hot spring reservoir), saturated brines, and residual brines. Based on the assumption that chloride is conserved in the waters during evaporative concentration, these stages are related to each other by the

concentration factors of about 1:28:870:7600:16,800. Budget calculations show that only bromide is conserved as completely as chloride. Sodium follows chloride closely until trona precipitation, whereas silica and sulfate are largely lost during the very first concentration step (dilute streamflow-dilute ground water). Seasonal runoff, principally from the valley floor north of Lake Magadi, is the principal recharge to the Magadi ground water system. Evaporative concentration is the overall process responsible for the chemical evolution of the brines. Data were obtained for borehole brines from as deep as 297 m. They show the existence of two distinct brine bodies below the present lake, one shallow, coexistent with bedded salts, and highly concentrated (260 g/kg average dissolved solids), and the other deeper in lacustrine sediments or fractured lavas, and only half as concentrated. (Woodard-USGS)
W77-06967

2L. Estuaries

EVALUATION OF POTENTIAL INDICATORS OF SUB-LETHAL TOXIC STRESS ON MARINE ZOOPLANKTON (FEEDING, FECUNDITY, RESPIRATION AND EXCRETION): CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
For primary bibliographic entry see Field 5A.
W77-06617

PARTICLE CHARACTERISTICS AND DISPERSAL PATTERNS OF SUGAR CANE WASTES IN SELECTED RIVERS AND ESTUARIES OF PUERTO RICO.
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W77-06632

CHLORINE REACTIONS WITH SEAWATER CONSTITUENTS AND THE INHIBITION OF PHOTOSYNTHESIS OF NATURAL MARINE PHYTOPLANKTON.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5C.
W77-06637

THE FAUNA OF THE POLLUTED RIVER TEES ESTUARY.
Leeds Univ. (England). Wellcome Marine Lab.
For primary bibliographic entry see Field 5C.
W77-06638

AN OFFSHORE BIOMONITORING SYSTEM FOR CHLORINATED HYDROCARBONS.
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5A.
W77-06641

EFFECTS OF PRESSURE, TEMPERATURE AND OXYGEN ON THE OXYGEN-CONSUMPTION RATE OF THE MIDWATER COPEPOD GAUSSIA PRINCEPS.
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 5C.
W77-06642

A STUDY TO FORECAST THE WAVES AT DIGHA.
River Research Inst., Calcutta (India).
S. K. Das Kaviraj, and S. K. Sarkar.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 27, No. 2, p 177-184, April 1976. 5 fig, 3 tab, 9 ref, 1 append.

Descriptors: *Waves(Water), *Ocean waves, *Winds, Coasts, Wind tides, Shore protection, Shores, Foreign countries, Foreign research, Measurement, On-site investigations, Model studies, Mathematical models, Frequency, Velocity, Height, Oceanography.
Identifiers: *India, *Digha(India).

Instrumental records of waves and wind speeds at Digha have been utilized to forecast wave characteristics, namely, the wave period and wave height. The spectrum of waves as devised by Neumann, has been used to establish an empirical relationship between the wind speed and the period of maximum wave height, also this has been used to derive a relationship between the wind speed and the optimum value of wave frequency. Co-cumulative power spectra have been used to study the distribution of energy, and the significant range of periods of the sea waves at different wind speeds. From the observed records, values of maximum wave heights at corresponding wind speeds were determined. An empirical relationship between the maximum wave height in deep sea, and the speed of the generating wind is established. Significant wave heights at corresponding wind speeds were also calculated, and a formula relating significant wave height to the wind speed was provided. (Sims-ISWS)
W77-06648

NILE CONE: LATE QUATERNARY STRATIGRAPHY AND SEDIMENT DISPERSAL.
Smithsonian Institution, Washington, D. C. Div. of Sedimentology.
D. J. Stanley, and A. Maldonado.
Nature, Vol. 266, No. 5598, p 129-135, March 10, 1977. 4 fig, 1 tab, 37 ref.

Descriptors: *Sedimentation, *Quaternary period, *Stratigraphy, Sediments, Deposition(Sediments), Cores, Core logging, Stratification, Carbon radioisotopes, Dams, Rivers, Deltas, Sedimentology.
Identifiers: *Mediterranean Sea, *Nile River, *Aswan Dam, *Nile Cone.

The cyclic nature of Late Quaternary Nile Cone sediments is a response to major climate oscillations, including marked changes in sea level, Nile river discharge and sediment influx, and water mass stratification. Deposits have accumulated most rapidly northwest of the Nile Rosetta Branch since the Early Wurm. A broad area of low sedimentation on the Cone, initiated during the Holocene sea level rise, is predicted to increase in size as a result of the Aswan High Dam and modification of Nile River flow. (Sims-ISWS)
W77-06650

MONITORING THE MARINE ENVIRONMENT THROUGH SEDIMENTATION.
Scripps Institution of Oceanography, La Jolla, Calif.
A. Soutar, S. A. Kling, P. A. Crill, E. Duffrin, and K. W. Bruland.
Nature, Vol. 266, No. 5598, p 136-139, March 10, 1977. 2 fig, 2 tab, 23 ref.

Descriptors: *Sedimentation, *Coasts, *Oceans, *California, Water pollution, Environment, Aquatic environment, Sediments, Deposition(Sediments), Bottom sediments, On-site investigations, Fish, Biology, Pollutants, Surveys, *Monitoring, Sedimentology.

The argument was advanced that the interception of particles settling within the water column provides a means of monitoring and understanding basic ocean processes. Geochemical and biological measurements on precisely dated bottom sediments and on preliminary recoveries from particle interceptor-traps provided supporting evidence. (Sims-ISWS)
W77-06651

Field 2—WATER CYCLE

Group 2L—Estuaries

EXCHANGE THROUGH A BARRIER ISLAND INLET: ADDITIONAL EVIDENCE OF UPWELLING OFF THE NORTHEAST COAST OF NORTH CAROLINA.
North Carolina State Univ., Raleigh. Dept. of Geosciences; and North Carolina State Univ., Raleigh. Center for Marine and Coastal Studies.
C. E. Knowles, and J. J. Singer.
Journal of Physical Oceanography, Vol. 7, No. 1, p 146-152, January 1977. 7 fig, 1 tab, 10 ref. NOAA 04-3-158-40.

Descriptors: *Upwelling, *Temperature, *Barrier islands, *North Carolina, Coastal engineering, Hydrographs, Salinity, Water temperature, Tidal effects, Wind tides, Current meters, Continental shelf, Inlets (Waterways).
Identifiers: *Oregon Inlet (NC), Tidal periodicity, Tidal fluctuations, Thermographs, Current velocity, Time-history record.

Hydrographic data were collected at Oregon Inlet, North Carolina, during the period June 20-July 2, 1973. Examination of the water temperature time-history record at three stations in and near the inlet showed: (1) that in 2 periods with predominately southerly winds, the temperature fluctuated in the range from 13.7 to 27.5 °C, with an apparent tidal periodicity; (2) that for nearly 48 hours between these 2 periods and with northeasterly winds, a nearly constant temperature of 22.0 to 22.5 °C was maintained in spite of normal tidal fluctuations; and (3) that this constant temperature period was bracketed by two 25 hour transitional periods that were initiated almost coincidentally with wind directional changes. It appears that the sequence and relationship of these wind and water temperature data could be explained by (as well as provide additional evidence and documentation of) wind-induced upwelling along the northeastern North Carolina coast. An important conclusion drawn from this sequence and relationship of data was that temperature, salinity, and current velocity records in and near a barrier island inlet could furnish much information about the exchange and mixing processes on the adjacent continental shelf, especially when there are large differences in temperature and salinity between the sound and shelf waters. (Roberts-ISWS)
W77-06654

PETROLEUM HYDROCARBONS FROM EFFLUENTS: DETECTION IN MARINE ENVIRONMENT.
Hunter Coll., New York. Dept. of Environmental Health Sciences.
For primary bibliographic entry see Field 5A.
W77-06660

AN ESTIMATE OF THE INPUT OF ATMOSPHERIC TRACE ELEMENTS INTO THE NORTH SEA AND THE CLYDE SEA (1972-3).
Atomic Energy Research Establishment, Harwell (England).
For primary bibliographic entry see Field 5B.
W77-06668

COMPUTING EOLIAN SAND TRANSPORT FROM ROUTINE WEATHER DATA.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.; and Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
S. A. Hsu.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A010 899, Price codes: A02 in paper copy, A01 in microfiche. In: Proceedings 14th Coastal Engineering Conference; June 1974, Copenhagen, Denmark: American Society of Civil Engineers, New York, p 1619-1626. 5 fig, 8 ref. NR 388 002, ONR N00014-69-A-0211-0003.

Descriptors: *Wind erosion, *Analytical techniques, *Aeolian soils, Equations, Winds, Velocity, Profiles, Sands, Movement, Weather data, Deserts, Coasts, Dunes, Erosion.

Extensive wind profile measurements were made over beaches, tidal flats, and small dune fields in Barbados, Ecuador, Florida, Texas, and on Alaskan Arctic coasts during the past several years. The linear relationship between shear and wind velocities was verified by these measurements, in conjunction with Bagnold's data (1941) from experiments in a Libyan desert. From the measurements, a simple method was developed for computing eolian transport of the most common sand particle sizes which occur on coasts and deserts by using routinely available wind observations from nearby weather stations. (Humphreys-ISWS)
W77-06669

METHANE-DERIVED CARBONATE CEMENTS IN BARRIER AND BEACH SANDS OF A SUBTROPICAL DELTA COMPLEX.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, and T. Whelan, III.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A015 162, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No. 199, Reprint from *Geochimica et Cosmochimica Acta*, Vol 39, p 1085-1089, December 1975. 2 fig, 1 tab, 25 ref. NR 388 002, ONR N00014-69-A-0211-0003.

Descriptors: *Sands, *Mississippi River, *Chemistry, Louisiana, *Cements, Beaches, Barrier islands, Coasts, Carbon, Methane, Carbonates, Sediments, Chemical analysis, Analytical techniques, Sampling.
Identifiers: *Mississippi Delta, *Chandeleur Islands (La), Cementation, Beach sands, Carbonate cements.

Highly negative delta C13 values, -18 to -40 parts per thousand, for carbonate cements found in Recent barrier and beach sands of the Mississippi River Delta complex strongly suggest that considerable carbon is furnished to the CaCO₃ cements by either chemical or biological oxidation of CH₄. These cemented sands are commonly found on beaches of the Chandeleur barrier island chain and other sites along the Louisiana coast where Holocene sands are rapidly transgressing over highly organic marsh deposits. Generation of CH₄ from underlying anoxic marsh sediment, followed by vertical migration and oxidation to CO₂ in the porous overlying sand, appears to be the unique set of conditions regulating this process of carbonate cementation. (Sims-ISWS)
W77-06677

NOTES ON THE NESTING SUCCESS AND FECUNDITY OF THE ANEMONEFISH AMPHIPRION CLARKII AT MIYAKE-JIMA, JAPAN.
Tatsuo Tanaka Memorial Biological Station, Tokyo (Japan).
For primary bibliographic entry see Field 5C.
W77-06763

ENVIRONMENTAL FACTORS AFFECTING SURVIVAL AND GROWTH OF VIBRIO PARAHAEEMOLYTICUS. A REVIEW.
Georgia Univ., Experiment. Div. of Food Science.
For primary bibliographic entry see Field 5C.
W77-06765

TEMPERATURE RELATIONS OF PUGET SOUND THAIDS IN REFERENCE TO THEIR INTERTIDAL DISTRIBUTION.
Western Washington State Coll., Bellingham. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-06767

EFFECT OF SALINITY ON SPORE GERMINATION OF TERRESTRIAL AND MARINE FUNGI.
Portsmouth Polytechnic (England) Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-06772

LONG-TERM LEAD ACCUMULATION IN ABALONE (HALIOTIS SPP.) FED ON LEAD-TREATED BROWN ALGAE (EGREGIA LAEVIGATA).
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5C.
W77-06776

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL.
Israel Oceanographic and Limnological Research Ltd., Haifa. Haifa Labs.
For primary bibliographic entry see Field 5C.
W77-06782

CORRELATION COEFFICIENTS AND CONCENTRATION FACTORS OF COPPER AND LEAD IN SEAWATER AND BENTHIC ALGAE.
Rutgers. The State Univ., New Brunswick, N. J. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-06783

A PRELIMINARY SURVEY OF MERCURY IN FISH FROM BOMBAY AND THANA ENVIRONMENT.
Institute of Science, Bombay (India). Inorganic and Nuclear Chemistry Lab.
For primary bibliographic entry see Field 5C.
W77-06785

HEAVY METALS IN MACROINVERTEBRATES AND FISH FROM THE LOWER MEDWAY ESTUARY, KENT.
Sir John Cass Coll., London (England). School of Sciences and Technology.
For primary bibliographic entry see Field 5C.
W77-06790

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 1: MARINE MAMMALS, MARINE BIRDS.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-06793

IDENTIFICATION, DOCUMENTATION AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA.
Alaska Dept. of Fish and Game, Fairbanks.
For primary bibliographic entry see Field 6G.
W77-06804

IDENTIFICATION, DOCUMENTATION, AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA, AND THE DISTRIBUTION, ABUNDANCE AND FEEDING ECOLOGY OF BIRDS ASSOCIATED WITH PACK ICE.
Alaska Dept. of Fish and Game, Fairbanks.
For primary bibliographic entry see Field 6G.
W77-06805

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL

INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 2: FISH, PLANKTON, BENTHOS, LITTORAL.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-06825

PELAGIC AND DEMERSAL FISH ASSESSMENT IN THE LOWER COOK INLET ESTUARY SYSTEM.
Alaska Dept. of Fish and Game, Kodiak.
For primary bibliographic entry see Field 6G.
W77-06829

BEAUFORT SEA ESTUARINE FISHERY STUDY.
Alaska Dept. of Fish and Game, Fairbanks. Div. of Sport Fish.
For primary bibliographic entry see Field 6G.
W77-06840

ASSESSMENT OF PELAGIC AND NEARSHORE FISH IN THREE BAYS ON SOUTHEAST KODIAK ISLAND.
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 6G.
W77-06846

DEMERSAL FISH AND SHELLFISH ASSESSMENT IN SELECTED ESTUARY SYSTEMS OF KODIAK ISLAND.
Alaska Dept. of Fish and Game, Kodiak.
For primary bibliographic entry see Field 6G.
W77-06847

THE DISTRIBUTION, ABUNDANCE AND DIVERSITY OF THE EPIFAUNAL BENTHIC ORGANISMS IN TWO (ALITAK AND UGAK) BAYS OF KODIAK ISLAND, ALASKA.
Alaska Univ., College Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06849

A COMPREHENSIVE PLAN FOR THE GLOBAL INVESTIGATION OF POLLUTION IN THE MARINE ENVIRONMENT AND BASELINE STUDY GUIDELINES.
United Nations Educational Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 5A.
W77-06850

A SELF-CONTAINED FACILITY FOR ANALYZING NEAR-BOTTOM FLOW AND ASSOCIATED SEDIMENT TRANSPORT.
Chicago Univ., Ill. Dept. of the Geophysical Sciences.
B. Lesht, R. V. White, and R. L. Miller.
NOAA Technical Memorandum ERL MESA-9, October 1976. 41 p., 11 fig., 1 tab., 11 ref., 4 photos.

Descriptors: *Sediment transport, New York, Flow characteristics, Facilities, Oceanographic equipment, Instrumentation.
Identifiers: Ocean floor, *New York Bight.

The field system described in this report was designed to monitor several aspects of the near bottom environment. The system can measure and record horizontal velocities at several levels within one meter of the ocean floor. Simultaneous measurements of wave pressure, mean current direction and turbidity can also be recorded. The recorded information is stored in digital format facilitating later analysis. The system is relatively inexpensive, flexible, and can be easily transported by small truck to the field location. Several experiments have been conducted with success in

the New York Bight between May 1974 and October 1975. These are summarized. Field operations are illustrated by a series of photographs. Preliminary analysis indicates that in the shallower experimental areas surface wave activity may have a significant effect on the flow field near the bottom even in slight seas. (NOAA)
W77-06874

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 5C.
W77-06875

THE NEW YORK BIGHT PROJECT - 1975; STONY BROOK, LONG ISLAND, NEW YORK.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 5G.
W77-06876

IMPACT OF OIL SPILLAGE FROM WORLD WAR II TANKER SINKINGS.
Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 5C.
W77-06877

PROGRAM DEVELOPMENT PLAN. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 6G.
W77-06878

A TEST PARTICLE DISPERSION STUDY IN MASSACHUSETTS BAY.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
NOAA Technical Report ERL 374-MESA 6. September 1976. 52 p., 13 fig., 2 tab., 10 ref., 10 append. Edited by R. H. Wing, Pacific Marine Environmental Laboratory, Seattle, Wash. NOAA-TR-ERL 374-MESA 6.

Descriptors: *Massachusetts, *Dispersion, *Sediment transport, *Meteorological data, *Resources development, *Baseline studies, Bays, *Mathematical models, *Forecasting.
Identifiers: *Oceanographic data, Particle dispersion, *Massachusetts Bay.

The goal of this study was to develop a predictive model to estimate, in advance of dredging operations, where the fines of a dredge plume would travel. On June 11, 1973, 2700 kg (3 tons) of small particles were released into the water column in Massachusetts Bay. Their movement was tracked for 10 days. Also, oceanographic data were collected and analyzed and a dispersion model was formulated. Final data show the plume movement to be westward toward Boston Harbor, eastward toward Stellwagen Bank and southward along the coast into Cape Cod Bay where a counter-clockwise gyre is suggested. (NOAA)
W77-06880

INVESTIGATION OF FLUSHING TIME IN THE LAFAYETTE RIVER, NORFOLK, VIRGINIA.
Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering.
C. H. Blair, J. H. Cox, and C. Y. Kuo.
Technical Report No. 76-C4, December 1976. 60 p., 22 fig., 6 tab., 16 ref.

Descriptors: *Virginia, *Estuaries, *Dyes, *Tracers, Monitoring, Water pollution, Path of pollutants.
Identifiers: *Flushing, Lafayette River estuary(Va).

Two consecutive dye tracer experiments were conducted in the Lafayette River during the period July 14 to August 29, 1976 in order to determine the flushing time of the estuary. Slug released of Rhodamine WT fluorescent dye in the north branch (km 8) and at the mouth of the main branch (k. 1.5) produced concentration fields which were periodically monitored. Additional parameters measured during these experiments included rainfall, salinity, and tidal height. Dye mass and center of dye mass in the estuary were determined. After tracer release at km 8 in dry summer conditions maximum dye concentration dropped 50% in about one day; about 1.5 days were required to flush 50% of the dye mass out of the north branch, while 9.5 days were required to flush a similar amount out of the mouth of the Lafayette River. When release occurred at km 1.5, about four days were required for maximum concentration to drop by 50%, while 5.5 days were required to flush 50% of the dye mass from the estuary. (NOAA)
W77-06881

LITTORAL DRIFT ESTIMATES ALONG THE COASTLINE OF FLORIDA.
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
T. J. Walton, Jr.
Sea Grant Report No. 13, August, 1976. 128 p., 13 fig., 17 ref., 3 append.

Descriptors: *Sediment transport, *Florida, *Littoral drift, *Data collections, Coasts, Erosion, Beaches, Engineers estimates, Design data.

Littoral drift roses are computed on a monthly averaged basis for possible use in feeder beach design and groin system design where a knowledge of seasonal sand movement is important, and in design of jetties where a knowledge of the monthly buildup of sand adjacent to the structure is of beneficial use in planning the construction phase of a project. The more important aspects of the data source and the computational results with a geomorphological interpretation of a section of coastline using the results. Additionally, heuristic comparisons of monthly littoral drift rates are presented where such comparisons can be made and a summary of the results of this study with implications for use of the data is given. Additionally, along with the monthly littoral drift roses, the annually averaged littoral drift roses have been included with new scales superimposed for ease of interpolating results. (NOAA)
W77-06882

EFFECTS OF ENGINEERING ACTIVITIES ON THE ECOLOGY OF PISMO CLAMS.
Moss Landing Marine Labs., Calif.
For primary bibliographic entry see Field 5C.
W77-06886

CONTINENTAL SHELF WAVES AND ALONGSHORE VARIATIONS IN BOTTOM TOPOGRAPHY AND COASTLINE.
Oregon State Univ., Corvallis, School of Oceanography.
J. S. Allen.
Journal of Physical Oceanography, Vol. 6, No. 6, p. 864-878, November 1976. 5 fig., 1 tab., 21 ref., 1 append. NSF DES75-15202, IDO 71-04211, OCE76-00596.

Descriptors: *Ocean waves, *Continental shelf, *Coasts, Waves(Water), Topography, Model studies, Mathematical models, Oceans, Shores, Equations, Continental slope, Winds, Oceanography.

Field 2—WATER CYCLE

Group 2L—Estuaries

The effects of alongshore variations in bottom topography and coastline on the wind-stress-forced barotropic motion over a continental shelf and slope were studied. Perturbation methods were used to obtain solutions for forced and free continental shelf waves on an idealized continental shelf and slope with small-amplitude alongshore variations in topography. The relevant alongshore scales, set by the wind stress and by the bottom and coastline topography, were assumed to be greater than the shelf-slope width. This enables the resulting motion to be treated in the long-wave nondispersive limit. As a result, the alongshore and time-dependent behavior of the perturbation flow is governed by a forced, first order wave equation, with terms from the interaction of the basic, lowest order flow with the bottom and coastline topography acting as the forcing function. To clarify the effects of topography alone, problems were considered where a uniform wind stress forces a basic unperturbed flow which is independent of the alongshore coordinate. In one example, a steady, alongshore-independent basic flow was established impulsively by a delta function application of the wind stress. The perturbation flow adjusts to the alongshore variations in topography through the propagation of disturbances as free continental shelf waves. There is an eventual establishment in the region of variable topography of a steady-state motion which follows contours of constant depth. (Sims-ISWS)

W77-06891

AN ANALYSIS OF INERTIAL OSCILLATIONS OBSERVED NEAR OREGON COAST.

Oregon State Univ., Corvallis. School of Oceanography.
P. K. Kundu.

Journal of Physical Oceanography, Vol. 6, No. 6, p 879-893, November 1976. 13 fig, 2 tab, 37 ref. NSF IDO 71-04211, OCE76-00596.

Descriptors: *Ocean currents, *Internal waves, *Continental shelf, *Oregon, *Pacific Ocean, On-site investigations, Model studies, Mathematical models, Waves(Water), Coasts, Currents(Water), Current meters, Measurement, Analytical techniques, Data processing, Oceans, Oceanography.

Identifiers: *Inertial oscillations.

Nearly two months of current meter data taken during the summer of 1973 at eleven depths at a station off the coast of Oregon in 100 m of water were analyzed. The spectra showed an 8% increase in the frequency of the inertial peak (ω about = 0.064 cph) above the local f (= 0.59 cph). Because of the proximity of the tidal frequencies to the local f , a sharp bandpass filter centered at $\omega = 0.064$ cph was used to isolate the inertial motions. The results showed that the amplitude of the inertial oscillations decayed slowly with depth, but the decay within about 10 m of the bottom was more rapid. A lagged correlation of the inertial currents clearly showed an upward propagation of phases throughout the water column at a speed of about 0.1 cm/s within the depth range 20-60 m. The inertial currents were found to turn clockwise (looking down) with depth, which corresponds to an upward phase and downward energy propagation; and the vertical phase speeds implied by the rates of turning agreed remarkably well with the lagged correlation calculations. The vertical wavelength was found to be of the order of the water depth. The vertical flux of energy into the bottom boundary layer during the occurrence of inertial bursts was estimated to be of the same order as the rate of turbulence production within the boundary layer, signifying that the inertial bursts can cause appreciable boundary layer stirring. (Sims-ISWS)

W77-06892

CIRCULATION AND HYDROGRAPHIC STRUCTURE OVER THE GHANA CONTINENTAL SHELF DURING THE 1974 UPWELLING.

Ghana Univ., Accra. Dept. of Physics.
R. W. Houghton.

Journal of Physical Oceanography, Vol. 6, No. 6, p 909-924, November 1976. 18 fig, 2 tab, 25 ref.

Descriptors: *Upwelling, *Continental shelf, *Atlantic Ocean, *Africa, Currents(Water), Ocean currents, Winds, Temperature, Water temperature, Salinity, Foreign countries, Current meters, Data processing, On-site investigations, Circulation, Ocean circulation, Coasts, Oceans, Hydrography, Oceanography.

Identifiers: *Ghana.

The changes in the circulation and hydrographic structure over the continental shelf south of Tema, Ghana, during the 1974 upwelling were described. For the first time in this region, an Aanderaa current meter mooring provided a continuous record of currents at three levels. During the onset of the upwelling, there was evidence of a vertical flow of 0.0008 m/s and an offshore flow at the surface of 0.07 m/s. A large vertical shear, which is a permanent feature throughout most of the year, vanished during the upwelling. Sea level changes were predominantly steric in origin. The upwelling event and the subsequent changes in the hydrography and circulation do not correlate with changes in the coastal wind. There were important differences between Ghana regime and that observed in other coastal upwelling areas. No simple driving mechanism was apparent. As a result, existing theoretical models may not be applicable. The possibility that waves of oceanic origin play an important role in the evolution of the coastal hydrography was discussed. (Sims-ISWS)

W77-06893

THE INFLUENCE OF WIND ON THE SURFACE LAYER OF A STRATIFIED INLET: PART I. OBSERVATIONS.

British Columbia Univ., Vancouver. Inst. of Oceanography.

D. M. Farmer, and T. R. Osborn.
Journal of Physical Oceanography, Vol. 6, No. 6, p 931-940, November 1976. 10 fig, 1 tab, 12 ref.

Descriptors: *Inlets(Waterways), *Estuaries, *Canada, *On-site investigations, Flow, Salinity, Winds, Instrumentation, Current meters, Data processing, Analytical techniques, Saline water-freshwater interfaces, Circulation, Water circulation, Currents(Water), Coasts, Oceanography.

Identifiers: *Alberni Inlet(British Columbia), British Columbia, *Vancouver Island.

Observations were reported of an experiment undertaken to determine the response of a stratified inlet to changing conditions of wind, tide, and runoff. Time series of conductivity profiles taken in Alberni Inlet, British Columbia, showed marked fluctuations in surface layer thickness that appear to be related to strong winds. The effect of an up-inlet wind is to produce a rapid thickening of the freshwater layer at the inlet head which may persist for several days. Strong winds were also associated with significant changes in the intensity of stratification. (See also W77-06895) (Sims-ISWS)

W77-06894

THE INFLUENCE OF WIND ON THE SURFACE LAYER OF A STRATIFIED INLET: PART II. ANALYSIS.

British Columbia Univ., Vancouver. Inst. of Oceanography.

D. M. Farmer.
Journal of Physical Oceanography, Vol. 6, No. 6, p 941-952, November 1976. 13 fig, 1 tab, 6 ref, 1 append.

Descriptors: *Inlets(Waterways), *Estuaries, *Canada, *Data processing, Analytical

techniques, Circulation, Water circulation, Winds, Tides, Diurnal, Model studies, Mathematical models, Saline water-freshwater interfaces, Currents(Water), On-site investigations, Oceanography.

Identifiers: *Alberni Inlet(British Columbia), *British Columbia, *Vancouver Island.

Analysis of the wind and current data for Alberni Inlet demonstrated the strongly wind-dependent nature of the surface currents, especially at the diurnal frequency. In contrast, the response of the surface layer thickness is mainly restricted to lower than diurnal frequencies. A linear two-layer model with allowance for friction was used to show that frictional damping can account for the poor coupling at high frequencies. In fact, the friction is sufficiently large to cause free modes to be critically damped (i.e., non-oscillatory). The model results compared favorably with the observations, using a frictional coefficient estimated from the decay of the internal tide. (See also W77-06894) (Sims-ISWS)

W77-06895

OBSERVATIONS OF WIND-GENERATED WAVES ON VARIABLE CURRENT.

National Aeronautics and Space Administration, Wallops Island, Va. Wallops Flight Center.
S. R. Long, and N. E. Huang.

Journal of Physical Oceanography, Vol. 6, No. 6, p 962-968, November 1976. 10 fig, 1 tab, 18 ref. NASA NAS6-2617.

Descriptors: *Waves(Water), *Winds, *Model studies, Hydraulic models, Currents(Water), Laboratory tests, Data processing, Analytical techniques, Ocean currents, Oceans, Oceanography.

Identifiers: *Wind-generated waves.

Laboratory measurements utilizing a laser probe were made for the slopes of wind waves generated on both positive and negative currents at different values of fetch. The data were then processed electronically to yield an average wave-slope spectrum in frequency space with 128 degrees of freedom. These spectra were used to obtain the growth of the spectral components at various frequency bands for increasing wind and different values of fetch and current. The results indicated that the growth of the spectral components is not monotonic with the frictional wind speed U_{sub} , but, rather, exhibits an 'overshoot' phenomena at lower values of U_{sub} . In addition, the growth of the spectral components displays a significant effect due to current. The peak location and spectral intensity of the spectra also show strong influence by the current condition, resulting in the rms surface slope value increasing with negative current and decreasing with positive current. The results agreed qualitatively with some theoretical predictions. The potential use of the current-induced effects as a means for remote sensing of ocean current was also briefly discussed. (Sims-ISWS)

W77-06896

MICROBIAL METHANE CONSUMPTION REACTIONS AND THEIR EFFECT ON METHANE DISTRIBUTIONS IN FRESHWATER AND MARINE ENVIRONMENTS.

Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.

W77-06899

INTERSTITIAL WATER CHEMISTRY OF ANOXIC LONG ISLAND SOUND SEDIMENTS. I. DISSOLVED GASES.

Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.

W77-06900

PARTICULATE TRANSPORT OF RADIONUCLIDES 14C AND 55FE TO DEEP WATERS IN THE PACIFIC OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 5B.
W77-06902

A DEVICE FOR MEASURING SEEPAGE FLUX IN LAKES AND ESTUARIES,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.

For primary bibliographic entry see Field 7B.
W77-06903

EVIDENCE FOR STRONG CURRENTS AND TURBULENCE IN A DEEP CORAL REEF GROOVE,

Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, S. P. Murray, and J. N. Suhayda.
Limnology and Oceanography, Vol 22, No 1, p 152-156, January 1977. 3 fig, 16 ref.

Descriptors: *Currents(Water), *Turbulence, *Coral, *Reefs, Sea water, Dyes, Islands, Diffusion, Turbulent flow, Mathematical studies, Photography.

Identifiers: *Diffusion coefficient, *Coral reef groove, Ambient current, Reef roughness elements, Coral heads, Island shelves, Sea floor, Coral-covered spurs.

High levels of turbulence (turbulence intensity approximately equals 23 cm/ss, diffusion coefficient approximately equals 2.4 x 1000 sq cm/s) and strong currents (approximately equals 35 cm/s) were found in a deep coral reef groove (approximately equals 33 m). This unexpected turbulence probably is related to the ambient current acting on reef roughness elements, e.g., coral heads. Well-developed coral communities that commonly occur at the deep margins of island shelves may be, in part, associated with these unusual levels of turbulent diffusion. (Roberts-ISWS)

W77-06904

EFFECT OF THE NILE FLOOD ON THE ESTUARINE AND COASTAL CIRCULATION PATTERN ALONG THE MEDITERRANEAN EGYPTIAN COAST,

Alexandria Univ. (Egypt). Dept. of Oceanography.
S. H. Sharaf El Din.
Hydrological Sciences Bulletin, Vol 21, No 3, p 451-461, September 1976. 8 fig, 11 ref.

Descriptors: *Flooding, *Currents(Water), *Effects, *Circulation, Discharge(Water), Flood data, Dams, Flood flow, Temperature, Coastal engineering, Marine geology, Hydrographs, Estuaries, Sea water, Estuarine environment, Foreign countries.

Identifiers: *Aswan High Dam, *Nile River, *Egypt, *Mediterranean Sea, *Port Said, Offshore region, Temperature-salinity diagrams, Flood effects.

Before 1964, 60-180 million tons of sediments and 16 X 10 to the 9th power to 64 X 10 to the 9th power cu m of water were transported yearly to the Mediterranean Sea by the Nile. During the flood period, before the erection of the High Dam, the estuarine circulation pattern was a two-layered flow at the mouths of the two estuaries. In winter, the area was filled with sea water. The latter condition became persistent during most of the year after 1964. The effects of the Nile flood on the water masses before and after 1964 were shown on temperature-salinity diagrams. The velocities of the currents at the mouths of the branches of the River Nile reached more than four knots at the surface and less than half a knot at the bottom during the flood period before 1964. After 1964, this velocity dropped considerably. Hydrographic sur-

veys before and after the closure of the High Dam indicated that the general oceanographic conditions in the offshore region did not change notably. The only difference between the pre-1964 and post-1964 conditions is that after 1964, no sediment was discharged from the Nile. This produced an imbalance in the near-coast sediment budget, with possible increased erosion along the shore. (Roberts-ISWS)

W77-06907

NUTRIENTS, CHLOROPHYLL, AND INTERNAL TIDES IN THE ST. LAWRENCE ESTUARY,

Laval Univ., Quebec. Department de Biologie.
For primary bibliographic entry see Field 5B.
W77-06910

HIGH SEAS OIL POLLUTION: PARTICULATE PETROLEUM RESIDUES IN THE NORTH ATLANTIC,

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 5B.
W77-06911

DISPERSION OF LIQUID WASTE FROM A MOVING BARGE,

Alabama Univ., Tuscaloosa.
For primary bibliographic entry see Field 5B.
W77-06913

IN SITU ACOUSTIC MEASUREMENTS OF MICROBUBBLES AT SEA,

Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.
H. Medwin.
Journal of Geophysical Research, Vol. 82, No. 6, p 971-976, February 20, 1977. 7 fig, 11 ref.

Descriptors: *Oceans, *California, *Bubbles, *On-site investigations, Measurement, Surveys, Instrumentation, Hydrophones, Acoustics, Winds, Marine biology, Oceanography.

Identifiers: *Monterey Bay(Calif), Microbubbles.

Excess acoustic attenuations in the frequency range 5-160 kHz were used to deduce densities of bubbles of radius of 15-300 micron at depths of 3-36 m in water up to 1 km deep. The measurements were made over an acoustic path 1-5 m long. Correlations have shown dependence on season, sun-down and sunrise, wind, and presence or absence of sea slicks and windrows. These inferred microbubbles are evidently of biological as well as physical origin. (Sims-ISWS)

W77-06916

INCIPIENT SEDIMENT MOTION IN ENTRANCES WITH SHELL BEDS,

Florida Univ., Gainesville. Dept. of Civil Engineering; and Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
A. J. Mehta, and B. A. Christensen.
Reprinted from: Proceedings of ASCE Symposium on Inland Waters for Navigation, Flood Control and Water Diversions, Colorado State University, August 10-12, 1976. p 960-977, 10 fig, 4 tab, 9 ref.

Descriptors: *Estuaries, *Coasts, *Sediment transport, Water resources, *Florida, Rivers, Sands, Stochastic processes, Shear stress, Gulf of Mexico.

Identifiers: Coastal zone, Shell beds, Stochastic models, Johns Pass(Fla), Blind Pass(Fla).

River and estuarine entrances are important components in reference to their contribution to the sand budget of the coastal zone. To test a stochastic model which predicts the critical bed shear stress for the incipient motion of coarse sediment grains at the point of bed erosion, given

the grain size and bed characteristics, data were obtained at two entrances - John's Pass and Blind Pass, on the Gulf Coast of Florida. The channel beds at these passes are laden with shells, and the transport of fine sand occurs over the shell bed. Results from the analysed data failed to agree with the well-known entrainment function relationship of Shields for horizontal beds with uniform grains, but compared very well with the entrainment function derived from the stochastic model. It is noted that the discrepancy with Shields' relationship is due to the non-uniformity of the shell bed and the relatively large ratio of the equivalent sand roughness of the shell bed to the median sand grain diameter. (NOAA)

W77-06930

MISSISSIPPI SOUND TEMPORAL AND SPATIAL DISTRIBUTION OF NUTRIENTS,

Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss. Gulf Coast Research Lab.
For primary bibliographic entry see Field 5B.
W77-06932

STATE INFORMATION NEEDS RELATED TO ONSHORE AND NEARSHORE EFFECTS OF OCS PETROLEUM DEVELOPMENT,

For primary bibliographic entry see Field 6G.
W77-06934

WHO'S MINDING THE SHORE. A CITIZENS' GUIDE TO COASTAL MANAGEMENT,

Natural Resources Defense Council, Inc., Palo Alto, Calif.

For primary bibliographic entry see Field 5G.

W77-06935

COASTAL FACILITY GUIDELINES: A METHODOLOGY FOR DEVELOPMENT WITH ENVIRONMENTAL CASE STUDIES ON MARINAS AND POWER PLANTS,

National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.

For primary bibliographic entry see Field 6G.

W77-06936

COASTAL ZONE MANAGEMENT, ANNOTATED BIBLIOGRAPHY,

National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.

D. Laist.
January 1977. 477 p.

Descriptors: *Bibliographies, *Coasts, *Management, *Estuaries, Land use, Resources development, Coastal topographic features.

Identifiers: *Coastal zone management.

The Coastal Zone Management Annotated Bibliography is a reference source for locating information developed through Federal and state coastal management (CZM) efforts supported in part or completely by funds authorized under the Coastal Zone Management Act of 1972 (Public Law 92-583). It includes documents prepared by the Office of Coastal Zone Management (OCZM), as well as selected products of coastal zone management programs in the states and territories. In chronological order, by state, 422 annotations are included, all of which are documents published between February 1974 and October 1976. (NOAA)

W77-06937

BLANK AND SALINITY CORRECTIONS FOR AUTOMATED NUTRIENT ANALYSIS OF ESTUARINE AND SEA WATERS,

New Hampshire Univ., Durham.
For primary bibliographic entry see Field 5A.
W77-06938

Field 2—WATER CYCLE

Group 2L—Estuaries

SAND STABILIZATION ON THE DUNES, BEACH AND SHOREFACE OF A HISTORICALLY ERODING BARRIER ISLAND. WAS-SAW ISLAND EROSION STUDY, PART III, Georgia Marine Science Center, Savannah. For primary bibliographic entry see Field 8G. W77-06940

MEASUREMENT IN A MARINE ENVIRONMENT USING LOW COST SENSORS OF TEMPERATURE AND DISSOLVED OXYGEN, National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service; and Geological Survey, Edgewater, Md. Water Resources Div. For primary bibliographic entry see Field 7B. W77-06960

DELAWARE RIVER: EVIDENCE FOR ITS FORMER EXTENSION TO WILMINGTON SUB-MARINE CANYON, Geological Survey, Woods Hole, Mass. Geologic Div. For primary bibliographic entry see Field 2E. W77-06966

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE CONJUNCTIVE USE OF A MULTI-RESERVOIR SYSTEM AND A DUAL-PURPOSE DESALTING PLANT, Sahand Co., Tehran (Iran). For primary bibliographic entry see Field 4B. W77-06714

3B. Water Yield Improvement

WEATHER MODIFICATION IN THE SOVIET UNION—1976, Arizona Univ., Tucson. Inst. of Atmospheric Physics. L. J. Battan. Bulletin of the American Meteorological Society, Vol. 58, No. 1, p 4-19, January 1977. 7 fig, 1 tab, 2 ref.

Descriptors: *Weather modification, *Cloud seeding, *Rainfall, *Hail, Silver iodide, Nucleation, Storms, Foreign research, Foreign countries, Convection, Thunderstorms, Radar, Precipitation (Atmospheric), Clouds, Cloud physics, Agriculture, Meteorology. Identifiers: *USSR, *Hail suppression, Rockets.

The USSR has a large investment in weather modification research and operations. Major cloud physics experimental facilities exist at the Institute of Experimental Meteorology and at the Institute of Geophysics of the Georgian Academy of Sciences. Hail suppression operations are being carried out over about 5,000,000 ha of farmland. Although claims of success in these activities are more modest than they were in 1969, it is still reported that the benefits far exceed the costs. There is relatively little research and, at this time, apparently only one small-scale operational program dealing with precipitation augmentation. Research in the Ukraine over the last three years has led scientists there to conclude that ice nuclei seeding of cumulonimbus clouds, over a substantial area, caused rainfall increases of about 30%. It also was reported that snow from frontal clouds was increased. (Sims-ISWS) W77-06644

ON THE STATUS OF HAIL SUPPRESSION, Illinois State Water Survey, Urbana.

S. A. Changnon, Jr. Bulletin of the American Meteorological Society, Vol. 58, No. 1, p 20-28, January 1977. 4 tab, 37 ref, 1 append. NSF ERP75-09980.

Descriptors: *Weather modification, *Cloud seeding, *Hail, Reviews, Silver iodide, Nucleation, Storms, Convection, Thunderstorms, Economics, Social impact, Surveys, Evaluation, Projects, Agriculture, Meteorology. Identifiers: *Hail suppression, Opinion surveys.

A technology assessment of the future potential of hail suppression and all its possible ramifications in the United States in future years has included an attempt to define the current status of hail suppression. Hail suppression is at a stage in which the socioeconomic impacts of its use and the means to optimize its future utilization can be adequately treated. The estimation of a wide range of future suppression capabilities was based on the current status, which was defined after three sources of information: (1) results from preliminary evaluations of six recent projects, (2) findings on four published assessments of weather modification, and (3) results from two opinion surveys. This investigation indicates: (1) scientific beliefs about existing capabilities are widely different, with the majority of experts believing there is no capability; (2) the published reviews are optimistic but largely nondefinitive; and (3) the results of five of six recent suppression projects show suppression levels of 20-50%, but the results are largely not significant at the 5% level. This difference between average beliefs of experts and the results of recent projects suggests the need for an extensive investigation of the data and results of these recent projects. (Sims-ISWS) W77-06645

COMPRESSED AIR FOR SUPERCOOLED FOG DISPERSAL, Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Meteorology Lab. A. I. Weinstein, and J. R. Hicks. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A019 409, Price codes: A03 in paper copy, A01 in microfiche. Report AFRL-TR-75-0561, October 22, 1975. 32 p, 10 fig, 4 tab, 13 ref.

Descriptors: *Fog, *Airports, *Weather modification, Laboratory tests, On-site investigations, Cloud seeding, Crystals, Ice, Equipment, Evaluation, Measurement, Meteorology. Identifiers: *Fog dispersal, Compressed air, Ice crystals, Supercooled fog, Airport runways.

Series of controlled and free environment tests were conducted to determine the technical feasibility of using the cooling resulting from the adiabatic expansion of compressed air to initiate ice crystal production in a supercooled fog. It was found that approximately 1000 cu cm of air, when compressed to 60 psig and released through a supersonic nozzle, will produce the same number of ice crystals as does the evaporation of 1 cu cm of liquid propane. An analysis was made of the Air Force locations in the U.S. and Europe where supercooled fog can be expected to most seriously restrict runway operations. The bases where such restrictions can be expected to be most acute are Elmendorf AFB, Fairchild AFB, Hahn AFB, Zweibrücken AB, and K.I. Sawyer AFB. The Air Force Air Weather Service is already conducting operational supercooled fog dispersal programs using liquid propane at the first three of these bases. Various methods of producing compressed air were described, and the operating cost advantage of using this technique in lieu of liquid propane was discussed. It is estimated that a compressed air system would consume approximately 1/17 as much fuel as would a system using liquid propane spray. In an average year, the estimated savings at Elmendorf AFB is projected to be over 34,000 gallons (129,000 liters) costing over \$16,000. (Sims-ISWS) W77-06674

SOME SIGNIFICANT REGULARITIES IN PLANT HYDROADAPTATION, (IN RUSSIAN), Yu. S. Grigor'ev. Izv Sib Otd Akad Nauk SSR SER Biol Nauk 2, p 82-89, 1976.

Descriptors: *Adaptation, *Dehydration, *Moisture content, *Drought resistance, *Drought tolerance, Xerophytes, Plant physiology, Water storage, Water conservation. Identifiers: Hydroadaptation, Hydrophyllization, Poikilohydrous plants, Homoiohydrous plants, U.S.S.R.

Two types or pathways of plant adaptation against desiccation on land exist. The passive type is peculiar to poikilohydrous plants (mainly lower plants) which do not regulate their water content and can tolerate more or less prolonged desiccation. The active type of adaptation is specific to higher plants. The latter are homoiohydrous possessing a complex of hydroregulating adaptations and capable of conserving water in tissues under desiccation. Two trends within the hydroadaptive rearrangement of land homoiohydrous plants exist: xerophyllization and hydrophyllization. During the xerophyllization process there is a strong hydroregulation adaptations.—Copyright 1976, Biological Abstracts, Inc. W77-06774

PLACE AND ROLE OF PLANT COVER IN OPTIMIZATION OF THE DONBAS NATURAL ENVIRONMENT, (IN UKRAINIAN), Akademiya Nauk USSR, Kiev. Instytut Botaniki; and Akademiya Nauk USSR, Kiev. Dept. of Geobotany and Paleobotany. For primary bibliographic entry see Field 4C. W77-06858

3C. Use Of Water Of Impaired Quality

IRRIGATION OF THE NEBIT-DAG PLANTINGS BY MINERALIZED GROUND WATER, (IN RUSSIAN), Nebit-Dag Bur. Greening 'Turkmenest' Assoc. (USSR). N. A. Ataev. Probl Osvo Pustyn' 4, p 93-94, 1975.

Descriptors: *Groundwater, *Mineralogy, Irrigation, *Irrigation practices, *Trees, Shrubs, Planting management. Identifiers: *Nebit-Dag (Turkmen SSR), USSR, *Mineralized groundwater.

Mineralized ground water (2.20-14.6 g/l mineralization rate) can be used to irrigate tree and shrub plantings in Nebit-Dagh (Turkmen SSR, USSR), the irrigation rate being 5000-6000 m³/ha. W77-06691

SALINITY EFFECTS ON RICE AFTER THE BOOT STAGE, Agricultural Research Service, Brawley, Calif. Imperial Valley Conservation Research Center. M. T. Kaddah, W. F. Lehman, B. D. Meek, and F. E. Robinson. Agronomy Journal, Vol. 67, No. 3, p 436-439, May-June 1975. 1 fig, 1 tab, 17 ref.

Descriptors: *Rice, *Salinity, *Crop response, *Salt tolerance, Flood irrigation, Crop production. Identifiers: *Rice paddy.

Effect of salinity on rice after the boot stage has been controversial in the literature. Some authors maintain that rice is sensitive to salt at flowering, whereas others have found no evidence to support these views. The present greenhouse study evaluates the interaction after the boot stage of salinity, soil texture, and rate of drainage on rice development. Soil and plant analyses showed that: (a)

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Conservation In Agriculture—Group 3F

Average salinities in the root zone were 2 to 4 times the salinities of the respective irrigation waters. In general, salinities increased with plant development and with decreasing rate of drainage. Salt components added to Colorado river water increased in both straw and grain without effect on yield. (b) Mature grain yield of S1 and S2 did not differ significantly; average grain yield of S3 and 84% of S1. More reduction in yield would be expected if rice was sensitive to salt after the boot stage. (Skogerboe-Color St)
W77-06871

THE IMPACT OF FERTILIZER USE AND CROP MANAGEMENT ON NITROGEN CONTENT OF SUBSURFACE WATER DRAINING FROM UPLAND AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Coshocton, Ohio. North Appalachian Experimental Watershed. For primary bibliographic entry see Field 5B.
W77-06909

WATER IN THE PALOUSE RIVER BASIN, WASHINGTON,
Geological Survey, Madison, Wis. Water Resources Div.; and Geological Survey Tacoma, Wash. Water Resources Div. For primary bibliographic entry see Field 4B.
W77-06978

AGRICULTURAL DISPOSAL OF AEROBIC WASTEWATER SLUDGES IN AN URBAN COUNTY,
Clermont County Water and Sewer District, Batavia, Ohio. For primary bibliographic entry see Field 5D.
W77-07057

LAND APPLICATION OF SEWAGE SLUDGE: IV. WHEAT GROWTH, N CONTENT, N FERTILIZER VALUE, AND N USE EFFICIENCY AS INFLUENCED BY SEWAGE SLUDGE AND WOOD WASTE MIXTURES,
Colorado State Univ., Fort Collins. Dept. of Agronomy. For primary bibliographic entry see Field 5D.
W77-07079

3D. Conservation In Domestic and Municipal Use

DESIGN STUDY OF ENVIRONMENTAL AND HUMAN CULTURAL INFORMATION SYSTEM NEEDS IN URBAN WATER RESOURCE DEVELOPMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Architecture and Urban Studies. For primary bibliographic entry see Field 6B.
W77-06634

OPEN SPACE AND URBAN WATER MANAGEMENT: PHASE II: CASE STUDIES AND FINDINGS,
North Carolina Univ. at Chapel. Dept. of City and Regional Planning. For primary bibliographic entry see Field 6B.
W77-06917

URBANIZATION AND FLOODING IN SHADES CREEK BASIN, JEFFERSON COUNTY, ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div. For primary bibliographic entry see Field 4C.
W77-06977

INTRODUCTION TO URBAN STORM WATER RUNOFF MODELS,
Water Resources Engineers, Springfield, Va. For primary bibliographic entry see Field 5B.
W77-07071

SIMPLIFIED METHODS OF COMPUTING THE QUANTITY OF URBAN RUNOFF,
Water Resources Engineers, Springfield, Va. For primary bibliographic entry see Field 5B.
W77-07072

THE WRE STORM MODEL,
Water Resources Engineers, Springfield, Va. For primary bibliographic entry see Field 5B.
W77-07073

3E. Conservation In Industry

MINERAL CONTENT OF SELECTED GEOTHERMAL WATERS,
Nevada Univ. System, Las Vegas. Water Resources Center. J. W. Sanders, and M. J. Miles. Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 419, Price codes: A03 in paper copy, A01 in microfiche. BuMines OFR 14-75, May 1974. 43 p, 3 fig, 10 tab, 9 ref, 7 append. BuMines G0133051.

Descriptors: *Geothermal studies, *Chemical properties, *Thermal springs, *Mineral water, *Water quality, *Geology, *Salts, *Springs, *Water properties, *Analysis, *Dissolved solids, *Chemical analysis, *Water analysis, *Analytical techniques, *Thermal water, *Thermal properties.

Identifiers: *Geothermal brines, *Mineral content, *Geothermal waters, *Mineral extraction, *Mineral quality, *Western United States, *Metallurgy, *Geothermal resources, *Chemical composition, *Geothermal wells, *Dissolved mineral content, *Mineral concentration, *Hot springs.

Interest is being focused on geothermal resources for their potential with regard to alleviating water and power demands of the future. The possibility of extracting minerals from geothermal brines is attractive and could lead to reduced costs for development of the overall geothermal resource. However, analytical information on which to develop extraction processes is inadequate. The objective of this study is to determine concentrations of minerals in geothermal brines in order that mineral recovery systems can be formulated and evaluated. Sixty-six samples were collected from geothermal areas and each sample was analyzed for 34 to 39 individual constituents. Nearly 860 analyses from about 420 geothermal sources in the Western United States were incorporated into a computerized storage and retrieval system. These data can be selectively retrieved according to any specified combination of parameters in order to expedite calculations or other data handling required for development and evaluation of mineral recovery procedures. (Henley-ISWS)
W77-06667

WATER DECONTAMINATION IN NORTHERN REGIONS BY IMPULSE ELECTRIC CHARGES, (IN RUSSIAN),
Toms'kii Meditsinskii Institut (USSR). For primary bibliographic entry see Field 5D.
W77-06791

GUIDELINES FOR THE PREPARATION OF ENVIRONMENTAL REPORTS FOR FOSSIL-FUELED STEAM ELECTRIC GENERATING STATIONS,
United Engineers and Constructors, Inc., Philadelphia, Pa. For primary bibliographic entry see Field 6G.
W77-06918

STATE-OF-THE-ART REVIEW OF PROCESSES FOR TREATMENT AND REUSE OF POTATO WASTES,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre. For primary bibliographic entry see Field 5D.
W77-06949

PROCEEDINGS TECHNOLOGY TRANSFER SEMINAR ON WASTE HANDLING, DISPOSAL AND RECOVERY IN THE METAL FINISHING INDUSTRY, NOVEMBER 12-13, 1975, TORONTO, ONTARIO,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre. For primary bibliographic entry see Field 5D.
W77-06950

ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 4: THE BACKGROUND PAPERS,
Stanford Research Inst., Menlo Park, Calif. For primary bibliographic entry see Field 6G.
W77-06957

HYDROCARBON PRODUCTS MANUFACTURE-BY CARBONISATION OF COAL, SCRAP RUBBER OR PLASTIC OR DOMESTIC SEWAGE UNDER REDUCED PRESSURE,
For primary bibliographic entry see Field 5D.
W77-07000

MUNICIPAL WASTE WATER TREATMENT AS AN INDUSTRIAL OPERATION,
Environmental Quality Systems, Inc., Rockville, Md. For primary bibliographic entry see Field 5D.
W77-07025

3F. Conservation In Agriculture

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMATILLA DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 2G.
W77-06602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREA, GRANDE RONDE DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 2G.
W77-06603

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, POWDER DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 2G.
W77-06604

OREGON'S LONG RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR RIVER DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 2G.
W77-06605

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, OWYHEE DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06606

CURRENT METHODS USED IN THE SOIL CONSERVATION SERVICE TO ESTIMATE SEDIMENT YIELD.
Soil Conservation Service, Fort Worth, Tex.
For primary bibliographic entry see Field 4D.
W77-06657

ECONOMIC ANALYSIS OF ALTERNATIVE GROUNDWATER WITHDRAWAL RATES IN CONJUNCTION WITH SURFACE WATER IRRIGATION.
Washington State Univ., Pullman, Coll. of Agriculture.
For primary bibliographic entry see Field 4B.
W77-06740

LAND FORMING SYSTEMS TO IMPROVE WATER USE EFFICIENCY.
Kansas State Univ., Manhattan, Dept. of Agricultural Engineering.
J. K. Koelliker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 021, Price Codes: A05 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Manhattan, KWRI Contribution No. 184, November 1976. 70 p, 14 fig, 11 tab, 44 ref, 3 append. OWRP A-068-KAN(2), 14-31-0001-5016.

Descriptors: *Land forming, *Terracing, Ground-water recharge, Rainfall, Recharge, *Soil moisture, *Kansas, Wheat, Grain sorghum, Fallowing, Model studies, *Water utilization, Demonstration watersheds, Crop production, Watershed management, Monitoring, Agricultural watersheds, Potential water supply.
Identifiers: Fallow efficiency.

Two years of operation of conservation bench terraces and level pans at Garden City, Kansas conclusive as to determining increased water use efficiency for crop production. Precipitation in both years was well below normal and little surface runoff occurred. Measurements of precipitation, watershed runoff and soil moisture in the top 2.3 m were monitored and used to calibrate a soil moisture budget simulation model for western Kansas. The model was calibrated with one year's data from a fallow watershed. Predicted total soil moisture content in the 2.1 m soil profile averaged within 2.4 percent of actual field values. The model was then used to estimate the potential for ground water recharge from conservation bench terraces over the period 1945-1974.
W77-06761

DEPENDENCE OF WATER ABSORPTION BY THE CELL WALLS OF PLANT LEAVES ON THE VOLUME OF THE FREE SPACE, (IN RUSSIAN).
Kazan Inst. of Biology (USSR).
For primary bibliographic entry see Field 2I.
W77-06827

SMOOTHING DATA WITH CUBIC SPLINES.
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 7C.
W77-06831

THE SIGNIFICANCE OF REGULATING THE WATER REGIME OF AGRICULTURAL LANDS, (IN RUSSIAN).
E. P. Eihe.

Latv Psr Zinat Akad Vestis 7, p 3-8, 1975.

Descriptors: Control, *Water balance, *Cultivation, *Water requirements, *Soil moisture, *Crop production, Water resources, Management, Cultivated lands, Drainage effects, Perennial ryegrass, Corn(Field), Oats, Vetch, Water pollution, Irrigation practices, Sprinkler irrigation, Confined waters, *Regulation.
Identifiers: Latvian-SSR, U.S.S.R.

The problems and importance of maintaining an air-water balance in cultivated lands are discussed. A drainage network that fulfills only a drainage function cannot adequately supply crops with water during the period of maximum demand. In order to ensure high and resistant yields, bilateral regulation of the soil water regime is necessary. The significance of such measures for crop yields is illustrated by data on a perennial grass mixture, silage corn, an oat-vetch mixture with ryegrass and feed cabbage. The problems of limited water resources for irrigation in the Latvian SSR (USSR), intensified by water pollution and the inappropriateness (in terms of pH and temperature) of artesian well waters, are outlined. Surface water reservoirs, underground moistening of the root zone and increased soil moisture capacity should be developed. The advantages of deep (to 50-100 cm) plowing of drained lands, vertical drainage-based drying and moistening, and synchronous impulse sprinkler irrigation are also described.—Copyright 1976, Biological Abstracts, Inc.
W77-06837

A METHOD OF EVALUATING A FIELD WATER CAPACITY USING PF-3, (IN FRENCH).
Institut National de la Recherche Agronomique, Toulouse (France). Station d'Agronomie.
For primary bibliographic entry see Field 2G.
W77-06844

POTASSIUM IN AN ARID LOESSIAL SOIL: CHANGES IN AVAILABILITY AS RELATED TO CROPPING AND FERTILIZATION.
Utah State Univ., Logan, Dept. of Soil and Meteorology.
D. W. James, W. H. Weaver, S. Roberts, and A. H. Hunter.
Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1111-1115, November-December 1975. 8 fig, 2 tab, 7 ref.

Descriptors: *Potassium, *Fertilizers, *Fertilization, Nutrients, Crop production, Cultivation, *Washington, Arid lands, Loam, Loess.

Two K fertilizer experiments were initiated in 1961 in arid central Washington on a Shano silt loam soil site that had been leveled to accommodate irrigation. The experiments were continued for 3 years and utilized rates of K fertilizer up to 320 kg K/ha in a randomized complete block design. By 1964 there existed a wide range of Kst (soil test K) as a result of the fixed random K treatments and partial exposure of K-deficient subsoils. That year the experiments were altered to completely randomized designs using both Kst and K fertilizer rates as controlled variables. The experiments were continued through 1970, providing an evaluation of the effects of crop management and K fertilization on soil K reserves. At low levels of Kst soil mineral K (Km) had a dominating influence, strongly buffering Kst changes involved with K removal (cropping) and K addition (fertilization). Whereas Kst serves as a good first approximation of soil K supply potential, supplemental information is required to fully describe the intensity and capacity factors in the K-soil-plant system. At comparable levels of Kst, the Shano silt loam profile is essentially homogeneous in regard to K availability. Therefore, special efforts to sample subsoils need not be made in routine fertility diagnosis of this soil series. (Skogerboe-Colo St)
W77-06870

THE EFFECT OF DIFFERENT METHODS ON GROWTH, DEVELOPMENT AND YIELD OF COTTON, (IN GERMAN).
Giessen Univ. (West Germany). Tropeninstitut; and Giessen Univ. (West Germany). Sektion fuer Pflanzenbau und Pflanzenzüchtung.
N. Atanasiu, N. Oezcuermuez, and A. Westphal.
Z. Acker-Pflanzenbau 142(1), p 20-31, 1976.

Descriptors: *Comparative productivity, *Irrigation systems, *Irrigation effects, *Cotton, *Crop response, Crop production, Investigations, Surface irrigation, Subsurface irrigation, Sprinkler irrigation, Semiarid climates.
Identifiers: *Turkey.

Comparative investigations were carried out to test the underground irrigation vs. different surface irrigation methods under semiarid conditions of W Turkey. The underground irrigation water was applied by means of plastic drainage pipes laid out at 4 depths (0.8, 1.0, 1.2 and 1.4 m) below the soil surface and plastic foils were placed under the pipes to avoid infiltration losses. This irrigation method was compared with border and furrow irrigation with 50, 70 or 90 mm water/application. Sprinkler irrigation and a control treatment (non-irrigated) were included. The applied quantities of water amounted to 270-280 mm within the irrigation period from the beginning of July to the end of Aug. There were no significant differences between the border and furrow irrigation. Treatments with 90 mm of water per application were superior to the other treatments. The underground irrigation at the depth of 0.8 m was superior as compared to the other depths (1.0-1.201.4 m). Lowest yield was obtained with sprinkler irrigation. The control showed absolutely lowest yields. There were characteristic differences between surface and underground irrigation in regard to the development of the cotton plant and growth of the vegetative and generative organs. With underground irrigation at 0.8 m depth the branches and buds were formed earlier, and the highest number of bolls (closed and open) was reached at an earlier date as compared with surface irrigation (furrow 90 mm). The maximum leaf number was obtained with underground irrigation. The furrow irrigation at 90 mm showed the highest yield in all 4 rounds followed by the underground irrigation in the yield range. The seed:lint ratio was closer with underground irrigation in favor of lint yield. The advantages of the underground irrigation system result from the constant distribution of the applied water in the root zone. Underground irrigation which results in an earlier and faster development of cotton plants as compared with the other methods, offers advantages to the growth of cotton plants especially in ecological semiarid regions like W Turkey, where the vegetative time is limited by temperature (germination temperature of 15°C at the beginning of May) in spring and by the start of the winter precipitation in autumn (Oct).—Copyright 1976, Biological Abstracts, Inc.
W77-06962

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE GROWTH SHAPERS: THE LAND USE IMPACTS OF INFRASTRUCTURE INVESTMENTS.
Urban Systems Research and Engineering, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 6D.
W77-06601

MIXING AND CIRCULATION OF LAKES AND RESERVOIRS WITH AIR PLUMES,
New Hampshire Univ. Durham. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W77-06633

A STUDY OF THE UTILIZATION OF EREP DATA FROM THE WABASH RIVER BASIN,
Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
For primary bibliographic entry see Field 7B.
W77-06670

DEBRIS BASINS FOR CONTROL OF SURFACE MINE SEDIMENTATION,
Kentucky Dept. for Natural Resources and Conservation, Frankfort. Office of Planning and Research.
For primary bibliographic entry see Field 5G.
W77-06672

EVALUATION OF THE ENVIRONMENTAL IMPACT TO APPALACHIAN PENNSYLVANIA WATERS OF THE 1972 FLOOD AND SUBSEQUENT STREAM CHANNELIZATION WITH FUTURE POLICY RECOMMENDATIONS.
Baker (Michael), Jr., Inc., Beaver, Pa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 659, Price codes: A14 in paper copy, A01 in microfiche. Report ARC-73-185-2562, September 1975. 319 p, 74 fig, 29 tab, 43 ref, 6 append. ARC 73-185.

Descriptors: *Floods, *Channel improvement, *Ecology, *Pennsylvania, Watersheds(Basins), Hurricanes, Streams, Flood damage, Historic floods, Water quality, Effects, Fish, Freshwater fishes, Trout, Benthos, Algae, Mining, Hydrology, Biology.
Identifiers: *Hurricane Agnes, Pennsylvania streams.

Geologic, engineering, and biological investigations of six coldwater Pennsylvania streams were undertaken to determine the impact of Tropical Storm Agnes and both pre- and post-flood stream channelization. The primary focus of the study was the ecological changes brought about by channel modification. No long-term deleterious effects of stream channelization on water quality, attached algae, benthic fauna, or forage fish populations were found. Trout were found to be greater in numbers and weight in natural stream reaches than in channelized reaches. Destruction of habitat appears to be the primary cause. Stream channelization was found often to be performed with a lack of adequate planning and supervision. A comprehensive planning process, as well as other recommendations, was set forth. (Sims-ISWS)
W77-06676

TWO-GOAL REGIONAL ENVIRONMENTAL POLICY: THE CASE OF THE SANTA ANA RIVER BASIN,
Tel-Aviv Univ. (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W77-06707

MATHEMATICAL MODELS IN HYDROLOGY.
United Nations Educational, Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 2A.
W77-06708

OPTIMAL OPERATIONS OF RESERVOIRS IN THE HARZ MOUNTAINS,
Technische Universität, Brunswick (West Germany). Leichtweiß Inst. for Water Research.
U. Maniak, and W. Trau.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland,

July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 901-907. 10 fig, 2 tab.

Descriptors: *Reservoir operation, *Simulation analysis, *Reservoir storage, *Reservoir releases, Monthly, Inflow, Frequency analysis, Municipal water, Water supply, Water demand, Synthetic hydrology, Hydrologic data, Queueing theory, Winter, Summer, Monte Carlo methods, Mathematical models, Systems analysis.
Identifiers: *Harz Mountains(Federal Republic of Germany), Conjunctive operation, Release rules.

The conjunctive operation of reservoirs for better use of natural resources requires well adjusted plans for the individual reservoirs. The operation of single-storage reservoir systems in the Harz Mountains in northern Germany is investigated using a simulation procedure covering a period of 500 years. The technique is based on the Monte Carlo method. The storage model is based on the principle of queueing theory, and the storage volume is determined for each month according to a synthetic monthly inflow and a certain service function which is referred to as the release rule of the system. Synthetic values of monthly inflows are generated by the simulation, using the appropriate distribution function for the transformation of the random numbers generated in the interval (0,1). The synthetic monthly inflow is added to the storage volume at the end of the preceding month and the monthly outflow is determined by the release rule. It is concluded that the mode of operation is highly dependent upon the purpose of the reservoir determining the release rule and entails certain patterns of frequency distribution curves of monthly reservoir storage. (See also W77-06708) (Bell-Cornell)
W77-06715

OPTIMIZATION MODEL OF A SYSTEM OF TWO OPEN-CHANNEL HYDROPLANTS,
Gdansk Technical Univ. (Poland). Inst. of Hydraulic Engineering.
T. Biernacki, and T. Piwecki.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 908-914. 4 fig, 2 ref.

Descriptors: *Powerplants, *Optimization, *Open channels, *Efficiencies, Operations, Peak loads, Daily, Inflow, Time constraints, Economic efficiency, Computer models, Hydraulic models, Equations, Systems analysis.
Identifiers: *Hydroplants, Benefit maximization, Saint Venant equation, Load curve, System efficiency, Energy system cost, Energy cost function.

In an electrical grid system having power produced mainly by thermal plants, it seems that a small number of hydro-power plants by their nature should cover the peak of the load curve. However, this is not obvious when the system consists in part of a thermal plant now unable to meet peak demands and of low head hydroplants which are sensitive to the variation of head. Careful analysis is then required accounting for hydraulic phenomena and thereby guaranteeing the optimal usage of the hydroplants to meet the appropriate part of the daily load diagram. This paper presents a hydraulic, economic, computer optimization model for two (or more) hydro-power plants connected by an open channel without storage. The problem is stated as follows: locate the two hydro-power plants in the load diagram so as to maximize the value of energy produced. Since the energy cost function illustrates the energy system costs resulting from participation of thermal power stations, the optimal time at which to operate the hydroplants is that giving the maximum value of energy produced by these hydroplants. Head losses and limited daily water inflow forces the hydroplants to cover different parts of the load diagram so as to optimize the operational cost. It is found that the computer model permits the energy output to be increased by several per cent, as com-

pared with results obtained from hand computation. (See also W77-06708) (Bell-Cornell)
W77-06716

METHODS FOR CONTROL OF THE REGIMES FOR WATER RESOURCES SYSTEMS,
Moskovskii Energeticheskii Institut (USSR). Dept. of Hydropower.
A. Sh. Reznikovskiy.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 915-918. 3 ref.

Descriptors: *Water resources, *Regulation, *Multiple purpose, Water storage, Behavior, Probability, Optimization, Equations, Mathematical models, Systems analysis, Reviews.
Identifiers: *Water systems, Hydroplants.

The definitions and characteristics of large multipurpose water systems are given in terms of system techniques. The basic problems and method for control of the regimes for water resources systems with water storage which are to regulate streamflow of different depths over the short seasonal and long-term period are considered. Special attention is given to the development of the hierarchy structure for control of the regimes for multipurpose systems whose water storages have unequal regulating potentialities and time differences in water coming. Some problems on further development of water resource systems are posed. (See also W77-06708) (Bell-Cornell)
W77-06717

OPTIMAL COMPLEX USE OF CONTROLLED WATER RESOURCES OF A BASIN,
Akademiya Nauk SSSR, Moscow. Central Economic Mathematical Inst.
B. S. Verkhovskii.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 919-925. 3 ref.

Descriptors: *Water resources, *Control, *Lakes, *Water storage, *Markov processes, Regulation, Time, Effects, Optimization, Probability, Stochastic processes, Drainage, Volume, Constraints, Irrigation systems, Equations, Algorithms, Mathematical models, Operations research.
Identifiers: *Stochastic programming, Benefit maximization.

The paper presents a model for optimal complex use of the water resources of a basin with year-to-year regulation of drainage by lake storage. The optimized system is assumed to operate for an extended period. Since it operates in a stochastically varying environment, the optimum criterion is taken to be the maximum mathematical expectation of the total effect (e.g., of net income), accounting for the revaluation of the different time effects. Described is an algorithm for finding the uniform markovian control. Considered next is a different approach—not involving analysis of controlled stochastic process—which has particular application to the optimum use of water resources for irrigation. The approach, called stochastic programming, is quite efficient. (See also W77-06708) (Bell-Cornell)
W77-06718

MATHEMATICAL MODEL OF WATER RESOURCES UTILIZATION IN A RIVER BASIN,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
Yu. A. Arkhangelsky, and L. V. Dounin-Barkovsky.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 926-935. 4 fig.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

Descriptors: *Water resources, *Water management(Applied), *Simulation analysis, *Algorithms, *River basins, Reservoir operation, Reservoir releases, Reservoirs, Hydrologic cycle, Long-term planning, Design, Optimization, Constraints, Water demand, Streamflow forecasting, Water utilization, Inflow, Estimating, *Mathematical models, Systems analysis.
Identifiers: *Syrdarya River(Middle Asia), Simultaneous operation, Water volume.

Extensive water resources systems providing water for vast areas and different users are becoming so complex that their effective control is possible only by the use of the newest cybernetic methods. Mathematical methods, used in combination with streamflow forecasting, are the most effective tools for obtaining optimal control rules. Use of these methods for the Syrdarya River basin, which is subject to various constraints, both natural and those of water demand, enables water resources to be used effectively. Presented is a complicated system of algorithms worked out for the purpose of water resources management to be used for the simulation of water systems under longterm planning and design. The mathematical model covers the whole hydrological cycle of the Syrdarya basin, one of the largest rivers of central Asia. The basin is divided into the following independent elements: (1) flow formation in the mountainous part; (2) transformation, use, and return of flow in the middle reaches; and (3) flow use in the lower reaches and its removal to the Aral Sea. The purpose of the system of algorithms is to check on the model and work out a method of estimating the optimal regime of simultaneous operation of the system of reservoirs in the basin. From the simulation results, the following are calculated: tables of optimal regimes of water releases from reservoirs for a series of years; tables of corrected values of water consumption; and a table of water consumption probabilities. (See also W77-06708)
W77-06719

OPTIMIZATION OF A THREE-RESERVOIR SYSTEM BY DYNAMIC PROGRAMMING.

Ministerio de Obras Publicas, Madrid (Spain).
Geologico Servicio.
L. L. Garcia.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 936-941. 2 fig, 1 ref.

Descriptors: *River systems, *Reservoirs, *Dynamic programming, *Water demand, *Hydrology, Economics, Reservoir operation, Monthly, Computer programs, Water supply, Synthetic hydrology, Probability, Hydrologic data, Benefits, Mathematical models, Systems analysis, Irrigation, Constraints, Monte Carlo method.
Identifiers: Benefit maximization, Spain.

A Y-shaped river system has one reservoir on each of the branches of the Y figure. Spills from reservoirs 1 and 2 feed reservoir 3. Reservoir 1 can feed reservoir 2 through a diversion canal. Each reservoir has an independent system of water users, including irrigation, municipal and industrial supply, flood control, power, and minimum streamflows. A dynamic programming algorithm optimizes the monthly operation of the system for a given input of hydrological data. Thus it is possible to run the program for several samples of synthetic hydrology. The set of results may be analyzed statistically and the optimal operating policy may be selected in terms of probability. The objective function is benefit maximization. The program may be used either for systems fitting into the configuration assumed or for complex systems which, when simplified, may be reduced to this pattern. (See also W77-06708) (Bell-Cornell)
W77-06720

OPTIMAL DESIGN AND OPERATION OF RESERVOIR SYSTEMS.

New South Wales Univ., Kensington (Australia).
School of Civil Engineering.
A. J. Askew, W. W. G. Yeh, and W. A. Hall.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 942-949. 1 fig, 6 ref. OWRT B-061-CALIF(14).

Descriptors: *Simulation analysis, *Reservoir operation, *Monte Carlo method, Streamflow forecasting, Hydrology, Reservoir design, Constraint, Optimization, Probability, Stochastic processes, Computer programs, Failures, Mathematical models, Systems analysis.
Identifiers: Release rules.

Many sophisticated analytical procedures produce output which is not related to any given probability of failure, and therefore they cannot be used with confidence in the design and operation of water resources systems. A simple procedure is proposed which involves the use of Monte Carlo techniques in deriving the optimum value for any particular parameter of a reservoir system. The purpose of the paper is to demonstrate the ease and simplicity of the simulation approach and to indicate how great a quantity of information regarding the response of a system can be derived from such an analysis. Herein, the constraints are imposed by setting maximum permissible probabilities of failure. The procedure can be used to analyze a variety of complex reservoir systems. Probability tables derived from the analysis may be employed to improve the efficiency of operation of the reservoir system, particularly where detailed knowledge of the streamflow forecasting capability is available. The financial benefit of such forecasts can thereby be assessed. (See also W77-06708) (Bell-Cornell)
W77-06721

CONSTRUCTION AND ADJUSTMENT OF A TWO-LAYER MATHEMATICAL MODEL OF THE LLOBREGAT DELTA.

Ministerio de Obras Publicas, Barcelona (Spain).
Computer Centre.
J. Cuena, and E. Custodio.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 950-964. 7 fig, 7 ref.

Descriptors: *Water resources, *Simulation analysis, *Aquifers, *Water management(Applied), Water supply, *Deltas, Optimum development plans, Water utilization, River regulation, Hydrology, Computer programs, Computer models, Saline water intrusion, Equations, Systems analysis, *Mathematical models.
Identifiers: *Barcelona(Spain), Llobregat Delta(Spain).

Barcelona, one of the two largest cities in Spain, has ever-increasing water supply problems. The present situation calls for the optimum utilization of all local resources rather than the construction of costly water transference canals. The local resources rather than the construction of costly water transference canals. The Llobregat River is the primary source of water and its associated alluvium acts as an important regulation system upon which many different types of supply are totally dependent. The aquifers in the Lower Llobregat and its delta have been modeled in order to provide a tool for optimizing their utilization and adequate management; however, at the opportune moment, they may be employed to stop, or at least reduce, the degree of sea-water intrusion and to improve artificial recharge. The mathematical model consists of two sets of superimposed polygons which simulate the two aquifers existing in the delta area. This model has certain special characteristics which were included in order to obtain a better adjustment to the boundary condi-

tions and to the local hydrological conditions of the area. The model, which appears to be a useful management tool, has been programmed in general form which will allow for processing by different types of computer, as well as admitting changes in the geometrical network and the input functions. (See also W77-06708) (Bell-Cornell)
W77-06722

INTEGRATION OF AQUIFERS IN FLOOD CONTROL PROJECTS.

Technion - Israel Inst. of Tech. Haifa. Dept. of Agricultural Eng.
N. Buras.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 965-977. 4 fig, 5 tab, 10 ref.

Descriptors: *Flood control, *Flood protection, *Aquifers, *Conjunctive use, *Linear programming, Reservoir operation, Reservoir releases, Flooding, River basins, Water storage, Streamflow, Irrigation, Constraints, Computer models, Flood damage, Equations, Mathematical models, Systems analysis, Optimization.
Identifiers: Damage minimization, Flood volume, Minimum release, Maximum release, Supply maximization.

The lower parts of river basins in many arid and semi-arid regions are often economically developed and intensively cultivated. Under such climatic conditions, wet season rainfall of high intensity may cause damaging floods. The system under consideration consists of surface components (a river and its tributaries, dams and reservoirs, and urban and irrigated areas) and of groundwater aquifers. The problem is to integrate operationally the aquifers within the system so as to minimize damages caused by flooding. A linear programming model has been set up and two modes of operating the system have been considered: (1) maximizing the release from the uppermost surface reservoir at the beginning of the wet season; and (2) minimizing this release. In both cases, the flood volume is diminished to the same amount, but the number of days when inundating streamflows occur is smaller in the first case. The factor limiting the effectiveness of the integration of aquifers within flood control projects is the rate of infiltration into these sub-surface formations. The system objective is to mitigate as much as possible the flood damages and, at the same time, to store as much water as possible for irrigation purposes. (See also W77-06708) (Bell-Cornell)
W77-06723

OPTIMAL SEASONAL AND SHORT-TERM OPERATION OF A RESERVOIR USED FOR FLOOD CONTROL AND WATER SUPPLY.

Water Research Association, Marlow (England).
J. A. Cole.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 978-988. 6 fig, 6 ref, append.

Descriptors: *Reservoir operation, *Dynamic programming, *Flood control, *Water supply, Multiple-purpose reservoirs, Regulation, Runoff, Decision making, Short-term planning, Seasonal, Monthly, Reservoir releases, Storm runoff, Water demand, Flooding, Hydrology, Downstream, Flood damage, Mathematical models, Systems analysis, Optimization.
Identifiers: Cost minimization, *Release rules, Reservoir contents.

Starting from an objective of minimizing the combined costs of deficient water supply and of flood damage downstream, the monthly release rules of a reservoir are found by using dynamic programming. Examples are shown of how the rules may depend not only on prevailing contents but

also on the previous monthly inflow. Methods of taking prior inflow into account, without having any significant increase in the problem's dimensions, are tested. Computational efficiency is also enhanced by limiting the number of decision states. Given the seasonal values of each contents state, as one result of the dynamic programming calculations, it is then shown how short-term regulation of the reservoir contents may be decided, using a quantitative forecast of storm runoff. (See also W77-06708) (Bell-Cornell)
W77-06724

STREAMFLOW REGULATION BY ARTIFICIAL RECHARGE FED FROM UPSTREAM SURFACE STORAGE: DERIVATION OF CONTROL RULES,

Water Research Association, Marlow (England).
T. Wyatt, D. G. Thorn, and P. A. Mawer.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 989-997. 7 fig, 4 ref.

Descriptors: *Streamflow, *Regulation, *Artificial recharge, *Dynamic programming, *Water storage, Groundwater, Surface waters, Upstream, Control, Aquifers, Conjunctive use, Constraints, Feasibility, Probability, Methodology, Costs, Markov processes, Algorithms, Rivers, Operations research, Mathematical models, Optimization.
Identifiers: *Direct search method, *Control rules, Hill-climbing technique.

The conjunctive use of ground and surface water resources has been extensively reported for cases where inflows to the two sources are not strongly linked. In contrast, this paper considers the special case of regulation of a common streamflow by combined surface storage and artificial groundwater recharge. Two methods are presented for finding control rules for regulating streamflow using an on-channel surface store conjunctively with abstraction from an artificial recharge to an aquifer. The two methods are based on direct search (hill-climbing) and dynamic programming methods. The objective is to minimize use of the aquifer, given that the operating costs of recharge/abstraction are higher than the costs of direct releases from the surface store. Comparative results are given for a single case, and further results show the considerable reductions in surface storage made possible with the conjunctive use of artificial recharge. (See also W77-06708) (Bell-Cornell)
W77-06725

THE METHODS OF DISTRIBUTION OF WATER RESOURCES IN RIVER DEVELOPMENT SYSTEMS,

Akademiya Nauk SSSR, Moscow. Institut Vodykh Problem.
A. L. Velikanov, and D. N. Korobova.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1001-1007. 3 fig, 3 ref.

Descriptors: *Water resources development, *Water distribution (Applied), *River systems, *Dynamic programming, Optimization, Feasibility, Regional development, Planning, Water balance, Equations, Mathematical models, Systems analysis.
Identifiers: Maximization, Effect function.

Examined is the general problem of distributing the water resources in river development systems, and methods of mathematical programming are shown to be essential for solving such problems. The feasibility of applying dynamic programming methods for solving problems of optimal distribution of water resources is investigated on the basis of a study of a river development system that contains water users and water consumers. The use of

dynamic programming methods for different schemes of river development is shown to call forth a need to account for the water balance and the limitations at each step of the solution. (See also W77-06708) (Bell-Cornell)
W77-06726

MODELE MATHEMATIQUE DE SIMULATION DU SYSTEME DES RESSOURCES HYDRAULIQUES SUPERFICIELLES DU LLOBREGAT,

Ministerio de Obras Publicas, Barcelona (Spain).
Study and Experimental Centre.
J. C. Bartolome.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1008-1016. 2 fig, 1 ref.

Descriptors: *River basins, *Simulation analysis, *Surface waters, Streamflow, Synthetic hydrology, Economics, Evaluation, Management, Stochastic processes, Alternative planning, Regional development, Hydraulics, Systems analysis, Mathematical models.
Identifiers: *River Llobregat (Spain).

This article is a general description of a mathematical model which simulates the surface water system of the basin of the River Llobregat in Spain. This description includes a general outline of the features of the basin, the generation of synthetic streamflow sequences at certain vital points within the basin, and the variables obtained as a result of the simulation process. The author describes generally the method of simulation; described also are the criteria employed in the economic evaluation of the statistical distribution of the variables in question, which were subsequently used to compare various solutions of basin management. (See also W77-06708) (Bell-Cornell)
W77-06727

CONJUNCTIVE USE OF THE TAJO-SEGURA AQUEDUCT SURFACE SYSTEM AND THE AQUIFERS OF THE LA MANCHA AREA,

Ministerio de Obras Publicas, Madrid (Spain).
Geologico Servicio.

For primary bibliographic entry see Field 4B.
W77-06728

OPTIMAL PLANNING OF FLOWS IN MULTI-RESERVOIR HYDRO-POWER SYSTEMS,

Boeing Computer Services Inc., Seattle, Wash.
Mathematical Analysis Unit.
S. L. S. Jacoby, and J. S. Kowalik.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1028-1039. 3 fig, 11 ref.

Descriptors: *Long-term planning, *Reservoirs, *Flow, Optimization, Reservoir storage, Constraints, Computers, Economic feasibility, Decision making, Equations, Mathematical models, Systems analysis.
Identifiers: *Nonlinear programming, *Hydro-power systems, Outflow, Sensitivity, Power deficit.

The problem of optimal planning of flows for a large number of relatively long time periods in multi-reservoir hydro-power systems is considered. It is shown that this is a nonlinear programming problem. The problem variables are either reservoir storage contents at the end of the planning periods or averages for the planning periods of reservoir outflows. The objective may be to minimize power deficit or to minimize the maximum of the power deficits in any of the planning periods. This large nonlinear programming problem needs to be solved repeatedly to study the sensitivity of the optimal plan to changes in systems configuration, side conditions and constraints. It is shown how to obtain a

meaningful model of the system on a computer and how to obtain a scheme enabling repeated computations in an accurate and economically feasible manner. (See also W77-06708) (Bell-Cornell)
W77-06730

HYDROLOGICAL EVALUATION OF CHANGES IN RUNOFF CHARACTERISTICS,

Hydrologic Engineering Center, Davis, Calif.
L. R. Beard.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1048-1055. 3 fig, 1 tab.

Descriptors: *Hydrology, *Evaluation, Effects, *Runoff, *River basin development, Economics, Urban runoff, Reservoir construction, Levees, Channel improvement, Floods, Assessment, Storms, Computer programs, Probability, Simulation analysis, Mathematical models, Systems analysis, *Floods.
Identifiers: Urban development, Lumped-parameter model, Unit hydrograph procedure.

In addition to natural changes, there are cultural changes such as urban development, channel and levee improvements, and reservoir construction that can greatly affect flood runoff characteristics in a river basin, particularly when such changes are spread throughout the river basin. Some changes affect small floods and do not appreciably change maximum flood potential. Other changes might not affect the frequency and extent of minor floods but can substantially moderate or aggravate large floods. Many parts of the river basin are affected differently by any specific change. In order to evaluate all effects at all locations adequately, it is necessary to examine a large number of flood events of various magnitudes and of various areal and temporal characteristics under each pertinent set of basin characteristics. Described is a lumped-parameter model designed to perform the hydrological and economic evaluations for any type of river basin and for urban development, reservoir construction, and for levee and channel improvement. An example is given of a portion of a river basin where extensive channel improvement is proposed for the purpose of relieving frequent overbank flooding, and a computer program designed to accomplish the evaluation is described. (See also W77-06708) (Bell-Cornell)
W77-06732

GENERAL DESCRIPTION OF THE VISTULA RIVER PROJECT AND BASIC PLANNING DATA,

Bureau of Studies and Designs for Hydraulic Structures, Warsaw (Poland).
M. Jedrysiak, A. Laski, and J. Zielinski.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco Paris, France, 1974, p 1056-1069. 2 fig, 3 tab.

Descriptors: *River basin development, *Projects, *Optimum development plans, Water shortage, Floods, Planning, Hydrologic data, Hydrologic aspects, Economics, Water requirements, Hydraulic structures, Water quality, Flood control, Mathematical models.
Identifiers: *Vistula River (Poland), Planning data.

The Vistula is the largest river in Poland and the development of its water resources has a fundamental significance for the overall development of the country. The most recent studies concerning comprehensive development of the Vistula River water resources were undertaken within the framework of the UNDP/UN Vistula River Project. These are a continuation of the previous studies which have been in progress for several years. The purpose of the Vistula River Project is to determine the optimal basin-wide solutions by applying mathematical modeling techniques. This

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

paper describes the Vistula basin and the Vistula River Project. Special emphasis is laid on the methodical preparation of the basic planning data and their scope (input data for the mathematical models). (See also W77-06708) (Bell-Cornell) W77-06733

THE MULTI-STEP METHOD FOR SIMULATION AND OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES.
Technical Univ., Warsaw (Poland). Inst. of Environmental Engineering.
Z. Kaczmarek, K. Krajewski, T. Kornatowski, A. Filipkowski, and J. Kindler.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1070-1075. 3 fig, 3 ref.

Descriptors: *River basins, *Reservoirs, *Alternative planning, *Simulation analysis, *Optimization, Dynamic programming, Stochastic processes, Linear programming, Long-term planning, Hydrology, Flow, Downstream, Water allocation(Policy), Water supply, Water demand, Investment, Reservoir releases, Reservoir storage, Decision making, Constraints, Equations, Mathematical models, Systems analysis.
Identifiers: *Vistula River(Poland), Target outflows, Operating rules, Inflow hydrology, Out-of-kilter algorithm, Cost minimization.

A multi-step method is described for the simulation of a multi-reservoir river basin system. The method entails the use of three separate models to determine the optimum planning alternatives for the Vistula River system. The first model is called The Target Outputs Model; using the out-of-kilter algorithm, which is a special purpose linear programming method, the model determines the optimal (minimum) target releases from individual reservoirs for given inflows, water demands, outflow constraints and penalty costs for water deficits. The second model, The Reservoir Operating Rules Model, utilizes stochastic dynamic programming and determines the reservoir releases in such a way that departures from the release targets are minimized for a given probability of distribution of inflows. It also finds the flows at control profiles downstream of the reservoirs. Finally, The Allocation Model considers the allocation of water deficits arising from the inability to meet all demands given the optimized operating rules from model number 2 and penalty costs for deficits. (See also W77-06708) (Bell-Cornell) W77-06734

THE OUT-OF-KILTER ALGORITHM AS A SINGLE-STEP METHOD FOR SIMULATION AND OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES.
Water Resources Engineers Inc., Walnut Creek, Calif.
I. P. King, J. Filipowski, and J. Kindler.
In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1076-1083. 7 fig, 3 ref.

Descriptors: *River basins, *Reservoirs, *Simulation analysis, *Optimization, *Alternative planning, Linear programming, Algorithms, *Water allocation(Policy), Water demand, Computer programs, Computer models, Networks, Methodology, River flow, Pumping, Costs, Constraints, Operations research.
Identifiers: *Out-of-kilter algorithms, *Vistula River(Poland), Target costs, Cost minimization.

A mathematical model is described for the simulation of a multi-reservoir river basin system. The system is set up as a network of arcs and nodes. A special purpose linear programming algorithm (the out-of-kilter algorithm) is used to find the optimal, least cost allocation of water to all demands. Overlapping time periods are used to eliminate the need

for prespecified policies for the reservoir. The entire model program is written in Fortran and processes up to 15 years with a basic net of 100 arcs in one simulation. The method is demonstrated using an example river network having three reservoirs and six points at which natural runoff is aggregated. (See also W77-06708) (Bell-Cornell) W77-06735

ENVIRONMENTAL IMPACT STATEMENTS IN WATER RESOURCES PLANNING AND DECISION MAKING.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6E. W77-06738

IMPROVEMENT OF PLANNING FOR POST-DEVELOPMENT WATER RESOURCE MANAGEMENT: A STUDY OF THE WEBER BASIN PROJECT.
Utah State Univ., Logan. Inst. for Social Science Research on Natural Research.
For primary bibliographic entry see Field 6B. W77-06739

CAUSES OF THE DRYING UP OF FORESTS IN THE FLOOD PLAIN OF THE LOWER REACHES OF THE URAL RIVER, (IN RUSSIAN).
For primary bibliographic entry see Field 4D. W77-06801

A MODEL FOR THE WATER REGIME OF A DECIDUOUS FOREST WITH SPECIAL CONSIDERATION OF THE FUNCTIONAL INTERRELATIONSHIPS AMONG METEOROLOGICAL FACTORS, SOIL WATER CONTENT AND EVAPOTRANSPIRATION, (IN GERMAN).
Eidgenössische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewässerschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 2A. W77-06864

FORECASTING FLOODS IN HAWAII (EXCLUDING HAWAII ISLAND).
National Weather Service, Honolulu, Hawaii. Pacific Region.
P. Haraguchi.
NOAA Technical Memorandum NWSTM PR-16, January 1977. 32 p, 10 fig, 6 tab, 37 ref.

Descriptors: *Hawaii, *Forecasting, *Warning systems, *Weather data, *Flood forecasting, *Flooding, Flood data, Rainfall, Thunderstorms, Lightning, Weather forecasting.

The floods from 1965 to the present (October 1976) were studied and the 11 most severe floods in respect to fatalities, monetary loss and areal extent were selected for detailed investigation. Observations of lightning and thunderstorms and short period intense rainfall were related to most floods since 1976. Data were insufficient for these studies prior to 1965. In summary there is, on the average, one severe localized flood a year. They occur mainly on Oahu, at night, from late November through early May. Flood damage averages about \$1 million and damage amounts are increasing yearly mainly because of more property construction and inflation. Fatalities are not common. A 500-mb trough is usually present west of the islands before flooding. On Oahu and Maui, flood associated with low level easterlies occurred on windward side or just lee of windward mountain while flood preceded by deep southwesterlies occurred in the normally dry leeward area. Lightning and thunder observations are good indicators of possible flooding. In the severe floods, the rainfall for 1/2, one, and two hours prior to flooding exceeded the critical rainfall values. (NOAA) W77-06873

FLOOD MANAGEMENT STUDY.

Northern Tier Regional Planning and Development Commission, Towanda, Pa.
For primary bibliographic entry see Field 6F. W77-06952

DELINEATION OF FLOOD HAZARD AREAS: FLOOD HAZARD REPORT NO. 2, RARITAN RIVER.

Anderson-Nichols and Co., Inc., Boston, Mass.
Prepared for Department of Environmental Protection, Division of Water Resources, State of New Jersey, March 1972. 30 p, 13 fig, 15 plates, 6 tab, 4 ref.

Descriptors: *New Jersey, *Floods, Flooding, *Design flood, *Flood profiles, *Floodways, *Flood plains, *Flood protection, *Non-structural alternatives, *Control structures, Streamflow forecasting, Historic floods, Peak discharge, Flood plain zoning, Flood plain insurance, Erosion control, Channel improvement, Watershed management.
Identifiers: *Raritan River(NJ), *Flood fringe area.

General reasons for flooding problems as well as specifics about the Raritan River situation are given. Three hundred and thirty-one lineal stream miles of flood plains were studied within the 1,100 sq mi of Raritan River Basin. This study covers the Raritan River and contains some information on 6 sub-watersheds: South Branch and North Branch Raritan River, Millstone River, Green Brook, Lawrence Brook and South River. A number of major floods have occurred since the earliest recorded in 1810. The 30.6 mi segment of the Raritan River in this report slopes at an average of 2.3 ft/mi and flows through 18 communities. Design discharges have been calculated for this region. For the Floodway, the discharge is 2.4 times the Mean Annual Flood and for the Flood Hazard Area it is 3.0 times the Mean Annual Flood. The peak discharge for the Floodway is 54,000 cubic feet per second and for the Flood Hazard Area, 67,500 cfs. Contour maps show the delineation of the Floodway and Flood Fringe Area. The following recommendations are given: communities along the river should establish regulations to control land use along the river; no fill or structure should be permitted in the floodway which would alter the natural flow of the river; in the flood fringe the lowest floor elevation should be at least a foot above the flood hazard design elevation; the possibility of structural flood reduction measures should be considered periodically; National Flood Insurance should be considered; and municipalities should consider taxing land that is not suitable for development because of location in a flood area. (Smith-North Carolina) W77-06953

FLOOD HAZARD INFORMATION: CAVE CREEK, ARIZONA CANAL TO 19TH AVENUE, PHOENIX, ARIZONA.

Army Engineer District, Los Angeles, Calif.
Prepared for Flood Control District of Maricopa County, Arizona, October 1971. 15 p, 5 fig, 13 plates.

Descriptors: *Arizona, *Floods, Flooding, *Flood profiles, *Flood plains, Flash flood, Annual flood, Streamflow forecasting, Maximum probable flood, Historic floods, Flood data, Peak discharge, Flood peak, Bank erosion, Floodways, Channels, Obstruction to flow, Dams, Channel improvement.
Identifiers: *Phoenix(AZ), *Cave Creek(AZ), *Intermediate Regional Flood, Arizona Canal(AZ), 50-year flood.

Land in the floodplains of this study area in the northwest part of Phoenix has been largely undeveloped to date, but pressure for development is expected to increase. Phoenix grew from a population of 107,000 in 1950 to 582,000 in 1970. The de-

mand for urbanization of flat land has been strong. Cave Creek, which drains 252 sq mi, originates in the mountains north of Phoenix and ends at its confluence with Arizona Canal. The flood season is generally from July through October, although floods can occur in any month. Floods are caused by general winter storms, general summer storms and local summer thunderstorms which cause flash floods, usually less than 3 hrs duration. Major floods occurred in 1905 and 1921. Cave Creek Dam, completed in 1923, serves as protection and has never been overtopped. The 1943 flood, largest since completion of the dam, had a peak discharge of 9,000 cubic ft/sec. It is predicted in an Intermediate Regional Flood, a peak discharge of 21,000 cfs will occur at the confluence of Cave Creek with Arizona Canal. Average channel velocities could range from 8-16 ft/sec. During a 50-year flood, a peak discharge of 13,000 cfs is anticipated with average channel velocities of 7-14 ft/sec. The sharp curve of the improved earth channel downstream from 19th Avenue could cause an erosion problem on the north and west bank of the channel. Several bridges over Cave Creek and Arizona Canal obstruct flood flows. In the past the canal has been overtopped several times. No federal flood control projects exist in the area, but Phoenix is undertaking some channel improvement. The Corps of Engineers has authorized a dam and channel system downstream of Cave Creek Dam. (Smith-North Carolina) W77-06954

RECONNAISSANCE OF THE WATER RESOURCES OF THE CLINTON QUADRANGLE, WEST-CENTRAL OKLAHOMA, Geological Survey, Oklahoma City, Okla. Water Resources Div. For primary bibliographic entry see Field 7C. W77-06959

SURFACE WATER NETWORK DESIGN BY REGRESSION ANALYSIS SIMULATION, Geological Survey, Reston, Va. Water Resources Div. For primary bibliographic entry see Field 2E. W77-06963

ANALOG-MODEL SIMULATIONS FOR SECONDARY CANAL CONTROLS AND FORWARD PUMPING WATER-MANAGEMENT SCHEMES IN SOUTHEAST FLORIDA, Geological Survey, Tallahassee, Fla. Water Resources Div. For primary bibliographic entry see Field 4B. W77-06968

PRELIMINARY ASSESSMENT OF THE WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON, Geological Survey, Tacoma, Wash. Water Resources Div. B. W. Drost. Open-file report 76-493, 1977. 89 p, 17 fig, 1 plate, 16 tab, 21 ref.

Descriptors: *Water resources, *Indian reservations, *Washington, *Available water, *Water quality, Surface waters, Groundwater resources, Aquifer characteristics, Hydrogeology, Water utilization, Water yield, Water demand, Chemical analysis, Water supply. Identifiers: *Tulalip Indian Reservation (Wash).

In 1974 about 30 percent of the nearly 600 acre-feet of water used on the Tulalip Indian Reservation, Washington, was obtained from a surface-water reservoir, while nearly 70 percent was obtained from ground-water sources. Domestic use accounted for about 93 percent of total water use. Nutrient (phosphorus) concentrations measured in most surface-water samples were less than the maximum limit recommended by the U.S. Environmental Protection Agency. The recommended maximum limit for total coliform bacteria was never exceeded. Ground water is withdrawn from aquifers in unconsolidated deposits. Shallow aquifers, which provide about 45 percent of the total ground-water supply, are tapped by about 250 wells and yield 5 to 20 gpm to 30- and 42-inch diameter dug wells. Deeper aquifers yield about 55 percent of the ground-water supply to about 125 wells that are mostly between 100 and 150 feet deep. Yields are generally at least 20 gpm to 6- and 8-inch wells, and several wells have yields exceeding 300 gpm. Water in the shallow aquifers generally had an excessive concentration of dissolved iron, often exceeding the recommended maximum limit of 0.30 mg/liter, and total coliform bacteria in water from six wells exceeded 1 colony per 100 milliliters of water. Some wells in the deeper aquifers yield water with dissolved iron and (or) manganese concentrations exceeding the recommended maximum limit of 0.30 and 0.05 mg/liter, respectively. Although many deep coastal wells bottom far below sea level, only two wells indicated local saltwater intrusion. An aquifer underlying the central plateau and an artesian aquifer in the northeastern part of the reservation appear to offer the best potential for development of additional ground-water supplies. (Woodard-USGS) W77-06971

IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS USING LANDSAT-1 (ERTS-1) IMAGERY, Geological Survey, Nashville, Tenn. Water Resources Div. E. F. Hollyday. Journal of Research of the U S Geological Survey, Vol 4, No 5, p 517-531, September-October 1976. 3 fig, 6 tab, 11 ref.

Descriptors: Streamflow forecasting, *Remote sensing, *Satellite (Artificial), *Aerial photography, *Photogrammetry, Equations, Methodology, Evaluation, Regression analysis, Statistical models, Watersheds (Basins), Delaware, Maryland, Virginia. Identifiers: *Delmarva Peninsula, Landsat-1.

Imagery from the first Earth Resources Technology Satellite (renamed Landsat-1) was used to discriminate physical features of drainage basins in an effort to improve equations used to estimate streamflow characteristics at gaged and ungaged sites. Records of 20 gaged basins in the Delmarva Peninsula of Maryland, Delaware, and Virginia were analyzed for 40 statistical streamflow characteristics. Equations relating these characteristics to basin characteristics were obtained by a technique of multiple linear regression. A control group of equations contains basin characteristics derived from maps. An experimental group of equations contains basin characteristics derived from both maps and imagery. Comparison of equations in the control group with corresponding equations in the experimental group reveals that for 12 out of 40 equations the standard error of estimate was reduced by more than 10 percent. It is concluded that data from Landsat imagery can substantially improve the accuracy of estimates of some streamflow characteristics at sites in the Delmarva Peninsula. (Woodard-USGS) W77-06972

COMPREHENSIVE MONITORING OF METEOROLOGY, HYDRAULICS, AND THERMAL REGIME OF THE SAN DIEGO AQUEDUCT, CALIFORNIA, Geological Survey, Bay St. Louis, Miss. Water Resources Div. For primary bibliographic entry see Field 2D. W77-06973

FLOODS IN LOUISIANA, MAGNITUDE AND FREQUENCY, THIRD EDITION, Geological Survey, Baton Rouge, La. Water Resources Div. For primary bibliographic entry see Field 2E. W77-06979

LONDON'S STORMWATER PROBLEM, Greater London Council (England). Water and Wastewater Section. For primary bibliographic entry see Field 5D. W77-06983

SEDIMENTS AND WATER QUALITY OF URBAN STORM WATER, Middlesex Polytechnic, London (England). For primary bibliographic entry see Field 5B. W77-06984

SIMPLIFIED METHODS OF COMPUTING THE QUANTITY OF URBAN RUNOFF, Water Resources Engineers, Springfield, Va. For primary bibliographic entry see Field 5B. W77-07072

ON-LINE ADAPTIVE CONTROL FOR COMBINED SEWER SYSTEMS, Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 5D. W77-07100

4B. Groundwater Management

CHEMICAL QUALITY OF EFFLUENTS AND THEIR INFLUENCE ON WATER QUALITY IN A SHALLOW AQUIFER, Los Alamos Scientific Lab., N. Mex. For primary bibliographic entry see Field 5B. W77-06658

MINERAL CONTENT OF SELECTED GEOTHERMAL WATERS, Nevada Univ. System, Las Vegas. Water Resources Center. For primary bibliographic entry see Field 3E. W77-06667

MONITORING GROUNDWATER QUALITY: ILLUSTRATIVE EXAMPLES. General Electric Co., Santa Barbara, Calif. Center for Advanced Studies. For primary bibliographic entry see Field 5A. W77-06673

ON LARGE-SCALE SIMULATION OF GROUNDWATER FLOW SYSTEMS, Institut fuer Wasserwirtschaft, Berlin (East Germany). K. Tiemer. In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2, IAHS/Unesco, Paris, France, 1974, p 887-891. 1 fig, 4 ref.

Descriptors: *Groundwater resources, *Simulation analysis, *Aquifers, *Subsurface investigations, Management, Water demand, Flow, Hydrogeology, Mathematical models, Equations, Systems analysis, Methodology. Identifiers: German Democratic Republic, Geohydraulic research, Subsurface reservoirs, Water availability.

The unfavorable relation between water demands and available water resources in the German Democratic Republic requires the optimal utilization of water resources, especially the efficient management of groundwater resources. To solve this problem, it is necessary to develop practicable

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

models of managed aquifers, an essential requirement for geohydraulic research in this country. In the areas of interest, the groundwater flow may be assumed to be in a horizontal plane. The difficulties of the mathematical problem result from the non-homogeneous hydrogeological properties of the aquifers and the complicated time-variable boundary conditions. However, combining mathematical and experimental methods it is possible to obtain acceptable approximate solutions, provided that all model parameters are known. In most cases, these parameters are widely unknown. Therefore, the simulation of typical groundwater situations is important for the development and testing of aquifer models. The effectiveness of the method presented herein—'Simulation of natural processes' or Indirect hydrological exploration—is demonstrated using an example of a subsurface reservoir. As a result of this investigation, a proven mathematical model is available as well as a practicable solution algorithm. The model constitutes an adequate basis for precalculating the effects of intended water management measures on the groundwater balance. (See also W77-06708) (Bell-Cornell)

W77-06713

THE CONJUNCTIVE USE OF A MULTI-RESERVOIR SYSTEM AND A DUAL-PURPOSE DESALTING PLANT,

Sahand Co., Tehran (Iran).

F. Mobasheri, and V. Budhraj.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 895-900. 2 fig, 2 tab, 6 ref.

Descriptors: *Conjunctive use, Surface waters, *Desalination plants, *Dynamic programming, *Multiple-purpose reservoirs, Optimization, Reservoir operation, Water supply, Economic efficiency, Simulation analysis, Algorithms, Computer models, Operations research, Mathematical models.

Identifiers: Benefit maximization.

Products from surface reservoirs are subject to natural fluctuations in supply due to uncertainty in projecting the future stream flow data. A desalting plant used as a reserve capacity provides the possibility of producing fresh water to fill firm water demand during critical periods of surface water supply. This means that the firm water supply from surface reservoirs can be raised in the conjunctive system. Benefit from such an increase in supply can be larger than the cost of a dual-purpose desalting plant which produces water during critical periods of surface water supply and electricity when there is no need for fresh water from the desalting plant. Using the incremental dynamic programming technique, a mathematical model is developed to find the optimum conjunctive use of surface and desalted water which maximizes benefits. Several reservoir system configurations are used, e.g., reservoirs in series on the same river and parallel in different rivers. Reservoirs are multi-purpose, providing flood control, power production, water supply, and water quality control. The model functions on monthly stream flow data. State variables are monthly storage levels in the reservoirs and decision variables are monthly releases from reservoirs and the amounts of water produced by the desalting plant. (See also W77-06708) (Bell-Cornell)

W77-06714

CONSTRUCTION AND ADJUSTMENT OF A TWO-LAYER MATHEMATICAL MODEL OF THE LLOBREGAT DELTA,

Ministerio de Obras Publicas, Barcelona (Spain). Computer Centre.

For primary bibliographic entry see Field 4A.

W77-06722

STREAMFLOW REGULATION BY ARTIFICIAL RECHARGE FED FROM UPSTREAM SURFACE STORAGE: DERIVATION OF CONTROL RULES,

Water Research Association, Marlow (England).

For primary bibliographic entry see Field 4A.

W77-06725

CONJUNCTIVE USE OF THE TAJO-SEGURA AQUEDUCT SURFACE SYSTEM AND THE AQUIFERS OF THE LA MANCHA AREA,

Ministerio de Obras Publicas, Madrid (Spain). Geologico Servicio.

A. Sahuquillo.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1017-1022. 2 fig, 5 ref.

Descriptors: *Conjunctive use, *Aqueducts, *Aquifers, *Surface waters, Alternative planning, Groundwater, Pumping, Water storage, Feasibility, Recharge, Water demand, *River basins, Regional development, Operations research.

Spain's Tajo-Segura Aqueduct, currently under construction, will divert 1200 Hm per year from the Tajo to the Segura Basin. The possibility of integrating the aquifers of the La Mancha area underlying the Aqueduct is discussed. Various alternatives are proposed: use of the water reserves; groundwater pumping only in dry years; use of the aquifers as storage units; feasibility of using the Aqueduct under a greater initial capacity in order to recharge the aquifers; or combinations of several of these alternatives. Groundwater studies are being carried out to obtain a better knowledge of these aquifers. (See also W77-06708) (Bell-Cornell)

W77-06728

HYBRID COMPUTER ANALYSIS OF A COMBINED SURFACE WATER-GROUNDWATER SYSTEM,

City Univ., London (England). Dept. of Civil Engineering.

W. J. Morris, and N. W. Morgan.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1023-1027. 4 fig, 6 ref.

Descriptors: *Hybrid computers, *Surface waters, *Groundwater, *Simulation analysis, Conjunctive use, Hydrology, Hydraulics, Management, Alternative planning, Aquifers, Equations, Mathematical models, Systems analysis, *Computer models.

Identifiers: Linear equation, Nonlinear equation, Groundwater levels.

An analysis of a combined surface water-groundwater system with the aid of a hybrid computer is outlined and an assessment is made of the importance of the nonlinear terms in the partial differential equations used for simulating the groundwater system. For purposes of this study, the surface water system is considered as including the unsaturated zone and the hydraulic and hydrological processes at ground level, and the groundwater system is considered as all water within the saturated zone. It is shown that the accuracy of a simulation of such a combined system using a hybrid computer is largely dependent on the availability and accuracy of the basic input data. A rapid and accurate evaluation of the controlling hydrological parameters can be made and the effect on groundwater levels of various water resource planning alternatives can be evaluated. (See also W77-06708) (Bell-Cornell)

W77-06729

ECONOMIC ANALYSIS OF ALTERNATIVE GROUNDWATER WITHDRAWAL RATES IN

CONJUNCTION WITH SURFACE WATER IRRIGATION,

Washington State Univ., Pullman. Coll. of Agriculture.

M. Feldman, N. K. Whittlesey, and W. R. Butcher. Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 026, Price codes: A07 in paper copy, A01 in microfiche. Washington Water Research Center, Pullman, Report No 27, September 1976. 126 p, 28 tab, 5 fig, 12 ref, append. OWRT B-051-WASH(2). 14-31-0001-3945.

Descriptors: Groundwater, *Withdrawal, *Conjunctive use, *Irrigation, Aquifers, *Economics, *Groundwater mining, *Input-output analysis, Water level.

Identifiers: Groundwater management.

Eastern Washington is experiencing rapid declines in groundwater levels due to irrigation pumping of the essentially fixed stock of groundwater. This study develops a conceptual framework for comparing economic factors of the present management policy to avoid exceeding a 10 foot per year decline in the static water level with alternative policies allowing greater decline rates or augmenting the water supply with surface water diverted from the Columbia River. A well cost model was developed to provide estimates of water costs for every potential well in the study area under alternative rates of water level decline. A computer model of the groundwater aquifer was utilized to provide estimates of the amount and location of the water that could be withdrawn from the aquifer while remaining within the limits of any management policy. An agricultural model (utilizing linear programming) calculated discounted net returns to agriculture, including non-irrigated agriculture, over a 50 year period. An input-output model was used to estimate the secondary economic impacts of additional irrigation development that could result from alternative management policies. Results showed that the actual depth from which water may be pumped depends heavily upon the rate of decline and the static water level. If water levels are relatively stable, water may be economically pumped from considerable depths. Rapid decline rates in the static water level will reduce the absolute depth at which water may be pumped economically. The results indicate that some economic gains would accrue to irrigated farms and the local economy under policies which encourage more water use. However, the economic gains are proportionately much less than the changes in water use required to induce the economic gain.

W77-06740

POLLUTANT MOVEMENT TO SHALLOW GROUND WATER TABLES FROM SWINE WASTE LAGOONS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.

For primary bibliographic entry see Field 5B.

W77-06742

FURTHER DEVELOPMENT AND TESTING OF A STREAM-AQUIFER SYSTEM MODEL,

Kansas Water Resources Research Inst., Lawrence.

For primary bibliographic entry see Field 2F.

W77-06762

STUDY OF LEACHATE AT LANDFILL SITES 1975, VOLUME 1.

Holzmacher, McLendon and Murrell, Melville, N.Y.

For primary bibliographic entry see Field 5B.

W77-06851

PRELIMINARY BIBLIOGRAPHY ON GROUNDWATER IN DEVELOPING COUNTRIES,

Association of Geoscientists for International Development, St. John's (Newfoundland).

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Groundwater Management—Group 4B

For primary bibliographic entry see Field 2F.
W77-06852

USGS SCIENTISTS BRING CALIFORNIA WATER SUPPLY INTO COMPLIANCE WITH FEDERAL REGULATIONS.
Geological Survey, Laguna Niguel, Calif.
For primary bibliographic entry see Field 5G.
W77-06853

WASTE INJECTION INTO STRATIFIED GROUND WATER BODIES.
Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-06855

HYDRAULICS AND ECONOMICS OF WELL FIELD LAYOUT.
Universal Oil Products, St. Paul, Minn. Johnson Div.
For primary bibliographic entry see Field 8B.
W77-06863

PERFORMANCE OF A RECHARGE AND RECOVERY SYSTEM IN AN AQUIFER WITH UNIFORM FLOW.
Technische Hogeschool, Delft (Netherlands). Geophysical Lab.
For primary bibliographic entry see Field 2F.
W77-06905

THE IMPACT OF FERTILIZER USE AND CROP MANAGEMENT ON NITROGEN CONTENT OF SUBSURFACE WATER DRAINING FROM UPLAND AGRICULTURAL WATERSHEDS.
Agricultural Research Service, Coshocton, Ohio. North Appalachian Experimental Watershed.
For primary bibliographic entry see Field 5B.
W77-06909

TABLES AND TYPE CURVES FOR ANALYSIS OF PUMP TESTS IN LEAKY PARALLEL-CHANNEL AQUIFERS.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
A. Vandenberg.
Technical Bulletin No 96, 1976. 28 p, 3 tab, 7 fig, 5 ref, 18 plates.

Descriptors: *Aquifers, *Leakage, Analysis, *Curves, Computer programs, *Canada, *Pumping.
Identifiers: *Parallel-channel aquifers, Esterhazy, Saskatchewan, *Leaky aquifers.

Analysis of drawdown data from pump tests in channel aquifers - as for example, buried bedrock channels - can be cumbersome when leakage effects and boundary effects set in simultaneously. Bukhari et al. (1969) have described a method for determining the leakage factor for cases where transmissivity and storativity can be determined from the early part of the drawdown data. Vandenberg (1976) has shown that if the distance measured along the axis of the channel between the pumped well and the observation well is greater than the width of the channel, the time-drawdown curve at the observation well can be closely approximated by assuming linear flow in the aquifer. This publication contains: (1) Extensive tables for the well function for leaky parallel-channel flow; (2) The corresponding type curves at a scale of 1.85 inches/log cycle, suitable for curve matching; (3) Several sets of type curves for cases where neither the method of Bukhari et al. (1969) nor of Vandenberg (1976) can be used; (4) A computer program for plotting type curves for leaky artesian drawdown in a parallel channel for any configuration of pumped well and observation well; and (5) Examples illustrating the use of the type curves. (WATDOC)

W77-06941

RECONNAISSANCE OF THE WATER RESOURCES OF THE CLINTON QUADRANGLE, WEST-CENTRAL OKLAHOMA.
Geological Survey, Oklahoma City, Okla. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-06959

COMPARISON OF ITERATIVE METHODS OF SOLVING TWO-DIMENSIONAL GROUND-WATER FLOW EQUATIONS.
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 2F.
W77-06965

ANALOG-MODEL SIMULATIONS FOR SECONDARY CANAL CONTROLS AND FORWARD PUMPING WATER-MANAGEMENT SCHEMES IN SOUTHEAST FLORIDA.
Geological Survey, Tallahassee, Fla. Water Resources Div.
E. H. Cordes, and R. A. Gardner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 825. Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 76-93, December 1976. 60 p, 35 fig, 9 tab, 10 ref.

Descriptors: *Model studies, *Flow control, *Canals, *Florida, *Analog models, Flow augmentation, Water management (Applied), Low-flow augmentation, Groundwater recharge, Water storage, Pumping, Water wells.
Identifiers: Southeast Florida, *Biscayne aquifer (Fla).

The analog model of the Biscayne aquifer of southeast Florida was used to approximate the effects of two proposed water-management schemes. One involved adding a secondary control structure in a major canal which is controlled near the coast. In the model the controls were operated in accordance with canal water level both above and below the secondary control. Although the model could not differentiate between control openings of 1 foot or 5 feet, it showed that the secondary control is a viable method of conserving ground water. The second scheme involved pumping ground water ('forward pumping') from the Biscayne aquifer in inland areas during the dry season to: (1) augment canal flows toward the coast to sustain ground-water levels there, and (2) generate additional ground-water storage space for recharge in the wet season. Several sites on the model were programmed for forward pumping wells and the storage change was noted as a percentage of the ground-water withdrawal. (Woodard-USGS)
W77-06968

HYDROLOGIC INTERPRETATION OF GEOPHYSICAL DATA FROM THE SOUTHEASTERN HUECO BOLSON, EL PASO AND HUDSPETH COUNTIES, TEXAS.
Geological Survey, El Paso, Tex. Water Resources Div.
J. S. Gates, and W. D. Stanley.
Open-file report 76-650, November 1976. 37 p, 6 fig, 1 tab, 26 ref.

Descriptors: *Groundwater resources, *Surveys, *Remote sensing, *Instrumentation, *Texas, Geophysics, Electrical resistance, Evaluation, Aircraft, Geological surveys, Aquifer characteristics, Supplemental irrigation, Water supply.
Identifiers: *El Paso area (Tex), Airborne-electromagnetic surveys, Earth-resistivity surveys.

Airborne-electromagnetic and earth-resistivity surveys were used to explore for fresh ground water in the Hueco Bolson southeast of El Paso,

Texas. Aerial surveys were made along about 500 miles of flight line, and 67 resistivity soundings were made along 110 miles of profile. The surveys did not indicate the presence of any large bodies of fresh ground water, but several areas may be underlain by small to moderate amounts of fresh to slightly saline water. The material underlying the flood plain of the Rio Grande is predominantly clay or sand of low resistivity. Along a band on the mesa next to and parallel to the flood plain, more resistive material composed partly of deposits of an ancient river channel extends to depths of about 400 to 1,700 feet. Locally, the lower part of this more resistive material is saturated with fresh to slightly saline water. The largest body of fresh to slightly saline ground water detected is between Fabens and Tornillo, Texas, mostly in the sandhill area between the flood plain and the mesa. Under assumed conditions, the total amount of water in storage may be as much as 400,000 to 800,000 acre-feet. The resistivity data indicate that the deep artesian zone southwest of Fabens extends from a depth of about 1,200 feet to about 2,800 feet. (Woodard-USGS)
W77-06970

PRELIMINARY ASSESSMENT OF THE WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON.
Geological Survey, Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-06971

REVIEW AND ANALYSIS OF HYDROGEOLOGIC CONDITIONS NEAR THE SITE OF A POTENTIAL NUCLEAR-WASTE REPOSITORY, EDDY AND LEA COUNTIES, NEW MEXICO.
Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-06974

GEOLOGY AND GROUND WATER IN DOOR COUNTY, WISCONSIN, WITH EMPHASIS ON CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE.
Geological Survey, Madison, Wis. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-06975

WATER IN THE PALOUSE RIVER BASIN, WASHINGTON.
Geological Survey, Madison, Wis. Water Resources Div.; and Geological Survey Tacoma, Wash. Water Resources Div.
E. G. Nassar, and K. L. Walters.
Washington Department of Ecology, (Olympia), Water-Supply Bulletin 39, 1976. 246 p, 22 fig, 1 plate, 20 tab, 46 ref.

Descriptors: *Water supply, *Water demand, *Watershed management, *Hydrologic budget, *Water resources, Surface waters, Groundwater, Water quality, Water utilization, Water well, Aquifers, Pumping, Drawdown, Surface-ground-water relationships, *Irrigation, Municipal water, Evaluation, Available water, *Washington.
Identifiers: *Palouse River basin (Wash).

Surface-water supplies are inadequate for irrigation in much of the Palouse River basin in eastern Washington, and dryland wheat farming characterizes much of the area. Along the valleys where farms are irrigated from streams, upstream diversions during the low-flow period have sometimes depleted streamflow to the detriment of downstream irrigators. However, suitable sites for reservoirs for storage of winter and spring streamflows for summer irrigation are scarce; also, the large quantity of sediment deposited by streams in the basin would limit the usefulness of reservoirs.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

A study directed toward defining low-flow characteristics of the streams could provide valuable information to water management agencies in the basin. A major ground-water problem exists in the heavily populated area of Pullman, where extensive pumping from wells for municipal supplies has lowered the artesian pressures to such an extent that wells that once flowed freely no longer do so. Any plan for continued development of the ground-water resource should include a wide spacing of new wells and a careful monitoring of water levels until the capacity of the local aquifers has been determined. Artificial recharge of aquifers may not be practical in the Palouse River basin because of the limited availability of surplus surface water to serve for recharge, and because the high sediment load in the surface water would require extensive treatment of the recharge water. (Woodard-USGS)
W77-06978

APPLICATION OF DIGITAL MODELLING TO THE PREDICTION OF RADIOISOTOPE MIGRATION IN GROUNDWATER.
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-06981

SUBSURFACE INJECTION—HOW MUCH DOES IT COST.
Black and Veatch, Denver, Colo.
For primary bibliographic entry see Field 5E.
W77-07011

WHAT'S NEW IN LANDFILL LINERS.
For primary bibliographic entry see Field 5G.
W77-07051

4C. Effects On Water Of Man's Non-Water Activities

ANTI-EROSION ROLE OF FOREST PLANTINGS IN THE STEPPE ZONE OF THE MOLDAVIAN SSR, (IN RUSSIAN).
N. A. Pinchuk.
Izv Akad Nauk Mold SSR Ser Biol Khim Nauk 3, p 10-14, 1975.

Descriptors: *Erosion control, *Planting management, *Forest management, *Sediment discharge, Soils, *Permeability, *Runoff, Regulation, Oak, Scotch pine trees, Trees, Black locust trees, Maple trees, Shrubs.
Identifiers: *Moldavian SSR, USSR.

The effect of antierosion tree plantings of different composition on runoff, sediment discharge and water permeability of soils was studied by the artificial sprinkling method on 0.5 x 0.5 m runoff microplots. In southern Moldavian-SSR (USSR) forest litter in antierosion plantings serves as a hydrologic regulator. To accumulate and preserve forest litter these plantings should be made with a dense shrub undergrowth of a shady or semishady structure, mainly with oak on soils with average erosion and Scots pine and black locust with Norway maple on severely eroded soils.—Copyright 1976, Biological Abstracts, Inc.
W77-06745

PLACE AND ROLE OF PLANT COVER IN OPTIMIZATION OF THE DONBAS NATURAL ENVIRONMENT, (IN UKRAINIAN).
Akademiya Nauk URSR, Kiev. Instytut Botaniki; and Akademiya Nauk URSR, Kiev. Dept. of Geobotany and Paleobotany.
V. S. Tkachenko.
Ukr Bot Zh 32(3), p 312-317, 1975.

Descriptors: *Vegetation effects, *Ecology, *Conservation, *Water yield improvement, Rivers, Protection, Forests, Erosion control, Vegetation, Optimization.
Identifiers: Biogeocenoses, Donbas, Plant cover, USSR, Ukrainian SSR.

A number of methods (forest amelioration, nature-protection, a geotechnology, organization-economics, engineering and technology) must be used to intensify the medium-forming role of the plant cover for the purpose of improving the Donbas (Ukrainian SSR, USSR) natural environment. The problem can be solved by preserving natural biogeocenoses and by creating artificial biogeocenoses. Certain practical recommendations are given for erosion control, increasing the water content of revers and for optimizing the natural environment.—Copyright 1976, Biological Abstracts, Inc.
W77-06858

STATE INFORMATION NEEDS RELATED TO ONSHORE AND NEARSHORE EFFECTS OF OCS PETROLEUM DEVELOPMENT.
For primary bibliographic entry see Field 6G.
W77-06934

SEDIMENT DISCHARGE FROM AN AREA OF HIGHWAY CONSTRUCTION, APPLEMAN'S RUN BASIN, COLUMBIA COUNTY, PENNSYLVANIA.
Geological Survey, Harrisburg, Pa. Water Resources Div.
D. A. V. Eckhardt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 616. Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-111, October 1976. 25 p, 6 fig, 4 tab, 16 ref.

Descriptors: *Sediment transport, *Sediment yield, *Soil erosion, *Road construction, *Storm runoff, Data collections, Turbidity, Sedimentation, Sediment control, *Pennsylvania.
Identifiers: Columbia County(Penn), Susquehanna River basin(Penn), Appleman's Run basin(Penn).

The effects of highway construction on stream sediment loads were studied in Appleman's Run basin, Columbia County, Pa., from October 1971 to May 1974. During the investigations, about 5,200 tons of suspended-sediment were discharged from the basin. Of this amount, about 2,700 tons, or about half the total sediment discharge, as derived from the highway construction area. Annual suspended-sediment yields from 17.5 acres under construction ranged from 40,000 to 66,000 tons/sq mi in the 1972 and 1973 water years, respectively. In the 1972 and 1973 er years of active construction, 83 percent of the sediment transported from the construction site was eroded each year in storms from January to June. Seasonal trends in sediment discharge for 1972 show that 69 percent of that year's suspended-load was transported in April, May, and June, whereas less than 1 percent was transported in July, August, and September. (Woodard-USGS)
W77-06969

URBANIZATION AND FLOODING IN SHADES CREEK BASIN, JEFFERSON COUNTY, ALABAMA.
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
A. L. Knight.
Alabama Geological Survey, University, Information Series 55, December 1976. 73 p, 42 fig, 11 tab, 8 ref.

Descriptors: *Flood control, *Urbanization, *Flood forecasting, *Computer models, *Alabama, Flood profiles, Flood frequency, Regression analysis, Storm runoff, Storm drains, Surface runoff, Planning, Urban hydrology, Watershed management.

Identifiers: Jefferson County(Ala), *Shades Creek basin.

The magnitude of the 25-, 50-, 100-, and 500-year floods for drainage basins having various degrees of urban development in Jefferson County, Alabama may be estimated from graphical and mathematical relations. The basic equations utilize the relations among drainage area, lag time, a length-slope parameter, and percent imperviousness for a particular drainage basin. The relations presented in this report, and the U.S. Geological Survey step-backwater computer program, were used to compute water-surface profiles along Shades Creek. Flood profiles and maps were determined on the basis of main channel conditions as surveyed prior to December 1973 but assuming complete urbanization within the remaining part of the drainage basin. A completely urbanized area is defined as an area where curbing, guttering, and storm sewers are complete and where more than 45 percent of the watershed has impervious cover. (Woodard-USGS)
W77-06977

DIMINUTION RATIOS FOR PLANNING CONSTRUCTION-AREA SEDIMENT CONTROLS.
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 4D.
W77-06980

4D. Watershed Protection

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMATILLA DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREA, GRANDE RONDE DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06603

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, POWDER DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06604

OREGON'S LONG RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR RIVER DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06605

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, OWYHEE DRAINAGE BASIN.
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06606

SEDIMENT YIELD PREDICTION BASED ON WATERSHED HYDROLOGY, Agricultural Research Service, Temple, Tex. J. R. Williams, and H. D. Berndt. Paper No. 76-2535, American Society of Agricultural Engineers 1976 Winter Meeting, Chicago, Illinois, December 14-17, 1976. 14 p, 3 tab, 12 ref.

Descriptors: *Sediment yield, *Forecasting, *Hydrology, Watersheds(Basins), Reservoir design, Model studies, Runoff, Computers, Erosion, Equations, Farm management, Erosion control, Costs, Curves, Soil moisture, Peak discharge. Identifiers: *Sediment-runoff model, *Modified universal soil loss equation, Sediment delivery ratio, Gross erosion.

A model for predicting sediment yield from unaged watersheds was developed by attaching a sediment yield model to hydrologic models. The sediment-runoff model is useful in reservoir design and water quality modeling because daily, monthly, and annual sediment yield can be predicted with simple inputs and low computer costs. (Visocky-ISWS) W77-06656

CURRENT METHODS USED IN THE SOIL CONSERVATION SERVICE TO ESTIMATE SEDIMENT YIELD, Soil Conservation Service, Fort Worth, Tex. E. C. Nicholas.

Paper No. 76-2532, American Society of Agricultural Engineers 1976 Winter Meeting, Chicago, Illinois, December 14-17, 1976. 8 p, 2 fig, 7 ref.

Descriptors: *Sediment yield, *Sedimentation rates, *Soil conservation, *Estimating, Forecasting, Equations, Erosion, Soil erosion, Suspended load, Deposition(Sediments), Methodology, Reservoirs, Land management, Farm management, Aerial photography, Curves. Identifiers: *Universal soil loss equation, Gross erosion, Sediment delivery ratio.

The four basic procedures currently used in the Soil Conservation Service to estimate sediment yield depending on the environment and available data are: (1) gross erosion and sediment delivery ratio estimates, (2) predictive equations, (3) suspended sediment load measurements, and (4) sediment accumulation measurements. For verification, it is desirable to use more than one method. (Visocky-ISWS) W77-06657

AN EXECUTIVE SUMMARY OF THREE EPA DEMONSTRATION PROGRAMS IN EROSION AND SEDIMENT CONTROL, Hittman Associates, Inc., Columbia, Md. For primary bibliographic entry see Field 5G. W77-06671

DEBRIS BASINS FOR CONTROL OF SURFACE MINE SEDIMENTATION, Kentucky Dept. for Natural Resources and Conservation, Frankfort. Office of Planning and Research. For primary bibliographic entry see Field 5G. W77-06672

ON THE APPLICATION OF OPTIMIZATION TECHNIQUES TO CONCEPTUAL CATCHMENT MODELS, Technische Universitaet, Dresden (East Germany). For primary bibliographic entry see Field 2A. W77-06709

ANTI-EROSION ROLE OF FOREST PLANTINGS IN THE STEPPE ZONE OF THE MOLDAVIAN SSR, (IN RUSSIAN), For primary bibliographic entry see Field 4C. W77-06745

CAUSES OF THE DRYING UP OF FORESTS IN THE FLOOD PLAIN OF THE LOWER REACHES OF THE URAL RIVER, (IN RUSSIAN), S. A. Nintin. Lesovedenie 5, p 66-69, 1975.

Descriptors: *Forests, *Flood plains, *Flood flow, *Drying, Irrigation, Forest management, Forest watersheds, Rivers, Downstream, Vegetation regrowth, Irrigation, Cutting management, Watershed management. Identifiers: *Ural River basin(USSR).

In flood-lands of the lower reaches of the Ural river (USSR) periodic thinning out of forests occurs in vast areas due to irregular flooding by high water flow. Irrigation of forested areas and timely cuttings of thinned stands to provide shoot regeneration are recommended.—Copyright 1976, Biological Abstracts, Inc. W77-06801

PLACE AND ROLE OF PLANT COVER IN OPTIMIZATION OF THE DONBAS NATURAL ENVIRONMENT, (IN UKRAINIAN), Akademiya Nauk URSR, Kiev. Instytut Botaniki; and Akademiya Nauk URSR, Kiev. Dept. of Geobotany and Paleobotany. For primary bibliographic entry see Field 4C. W77-06858

LOSS OF 2,4-D IN RUNOFF FROM PLOTS RECEIVING SIMULATED RAINFALL AND FROM A SMALL AGRICULTURAL WATERSHED, Southern Piedmont Conservation Research Center, Watkinsville, Ga. For primary bibliographic entry see Field 5B. W77-06908

OPEN SPACE AND URBAN WATER MANAGEMENT - PHASE II: CASE STUDIES AND FINDINGS, North Carolina Univ. at Chapel. Dept. of City and Regional Planning. For primary bibliographic entry see Field 6B. W77-06917

SEDIMENT DISCHARGE FROM AN AREA OF HIGHWAY CONSTRUCTION, APPLEMAN'S RUN BASIN, COLUMBIA COUNTY, PENNSYLVANIA, Geological Survey, Harrisburg, Pa. Water Resources Div. For primary bibliographic entry see Field 4C. W77-06969

URBANIZATION AND FLOODING IN SHADES CREEK BASIN, JEFFERSON COUNTY, ALABAMA, Geological Survey, Tuscaloosa, Ala. Water Resources Div. For primary bibliographic entry see Field 4C. W77-06977

WATER IN THE PALOUSE RIVER BASIN, WASHINGTON, Geological Survey, Madison, Wis. Water Resources Div.; and Geological Survey Tacoma, Wash. Water Resources Div. For primary bibliographic entry see Field 4B. W77-06978

DIMINUTION RATIOS FOR PLANNING CONSTRUCTION-AREA SEDIMENT CONTROLS, Geological Survey, Reston, Va. Water Resources Div. H. P. Guy. In: Proceedings of National Symposium on Urban Hydrology, Hydraulics, and Sediment Control,

July 26-29, 1976, University of Kentucky, Lexington, Kentucky, p 91-97, 1976. 7 fig, 14 ref.

Descriptors: *Sediment control, *Erosion control, *Land management, Planning, Construction, Agriculture, Watershed management, Topography, Sediment yield, Analytical techniques. Identifiers: Diminution ratio.

Planning erosion-control programs to limit sediment concentration in streams where part of the drainage basin is construction area requires knowledge in the ratio of construction-area to rural-area concentration and the relative construction area of the basin. The diminution ratio required to obtain a specific stream concentration can be computed on the basis of these construction- and rural-area concentration determined from the Universal Soil Loss equation. The diminution ratio required to obtain a specific stream concentration can be computed on the basis of these construction- and rural-area concentrations determined from the Universal Soil Loss equation. The diminution ratio is the product of the factors necessary to achieve a specific limit of average sediment concentration in the stream draining the basin. Included are (1) the ratio of construction area to total area, (2) the sediment delivery factor, (3) the cropping management factor, and (4) the conservation practice factor. A map of the eastern United States shows diminution ratios based on a discharge-weighted annual stream-sediment concentration of 2,000 mg/liter, a soil erosivity factor of 0.4 a topographic effect factor of 1.0, and average annual stream-flow given by U.S. Geological Survey Hydrologic Atlas 212. (Woodard-USGS) W77-06980

5. WATER QUALITY MANAGEMENT AND PROTECTION

GAS BUBBLE DISEASE OF SALMONIDS: A CRITICAL REVIEW, Bureau of Sport Fisheries and Wildlife, Seattle, Wash. Western Fish Disease Lab. R. R. Rucker. Technical Paper No. 58, February 1972, 11 p., 3 tab., 35 ref.

Descriptors: Freshwater fish, *Fish diseases, *Fish hatcheries, Atmospheric gases, *Animal pathology, Oxygen, Nitrogen, Supersaturation, Water temperature, *Metabolism, Carbon dioxide, Analytical technique, Gas chromatography, Mass spectrometry, Saturation, Reviews. Identifiers: Saturation tables, *Gas bubble disease, *Nitrogen supersaturation.

Fish maintained in water supersaturated with air reach equilibrium with the gases dissolved in water. These gases in the fish tend to equilibrate to the atmosphere the same as the gases in the water. Gas-bubble disease is characterized by bubbles under the skin, in the fins, tail, mouth, behind the eyeballs, and in the vascular system. Carbon dioxide does not cause gas-bubble disease. Oxygen can cause gas-bubble even below 350 percent air saturation, but nitrogen can cause the disease even below 118 percent air saturation. Excess gas in water can be produced by pressure, increase in temperature, and biotic metabolism, and can be reduced by exposure to air. Carbon dioxide and oxygen can be quantitated by titrimetry, while nitrogen analysis requires manometry, gas chromatography, or mass spectrometry. Saturation tables for atmospheric oxygen and nitrogen in water for 0 to 30°C. are presented. (Katz) W77-06920

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

5A. Identification Of Pollutants

A BIOLOGICAL MONITORING SYSTEM EMPLOYING RHEOTAXIS OF FISH, BADEN-WÜRTTEMBERG LANDESANSTALT FÜR UMWELTSCHUTZ (WEST GERMANY).
For primary bibliographic entry see Field 5C.
W77-06609

EFFECT OF MALACHITE GREEN AND FORMALIN ON THE SURVIVAL OF LARGemouth bass EGGS AND FRY, Cheraw National Fish Hatchery, S. C.
For primary bibliographic entry see Field 5C.
W77-06612

A PNEUMATIC GRAB FOR OBTAINING LARGE, UNDISTURBED MUD SAMPLES: ITS CONSTRUCTION AND SOME APPLICATIONS FOR MEASURING THE GROWTH OF LARVAE AND EMERGENCE OF ADULT CHIRONOMIDAE, Institute of Terrestrial Ecology, Edinburgh (Scotland), Wetlands Research Group.
T. D. Murray, and W. N. Charles.
Freshwater Biology, Vol. 5, No. 2, p 205-210, 1975. 3 fig, 6 ref.

Descriptors: *Sampling, Equipment, *On-site investigations, *Technology, *Bottom sampling, *Benthic fauna, *Methodology, On-site data collections, Research equipment, Benthos, *Diptera, Mud, *Diptera.
Identifiers: *Pneumatic grab.

A description is given of the construction and operation of a pneumatic grab for taking samples of mud 0.25 square meters in area, which can be removed without disturbance. It is of value in a variety of studies, and examples are given for its use in maintaining enclosed benthic populations and for measuring the emergence of adult Chironomidae. An emergence trap and box liners used for enclosing experimental benthic populations for use in conjunction with the pneumatic grab are described. (Katz)
W77-06613

ZOOPLANKTON SAMPLING VARIABILITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Woods Hole Oceanographic Institution, Mass.
T. J. Lawson, and G. D. Grice.
Bulletin of Marine Science, Vol. 27(1), p. 80-84, 1977. 2 tab, 2 fig, 9 ref.

Descriptors: *Zooplankton, *Distribution, *Nets, *Sampling, *Variability, On-site data collection, Correlation analysis, Statistics, Analytical techniques, Methodology.
Identifiers: *Controlled experimental ecosystem, *Schindler plankton trap, Bongo net.

Zooplankton sampling variability in controlled experimental ecosystems (CEEs) was investigated using a small, vertically-hauled net and a Schindler plankton trap. Following sampling, all the zooplankton in the CEEs were collected by filtering the water. Based on precision, accuracy, and comparability between experiments, vertically integrated net hauls provide the best measure of zooplankton abundance in CEEs. (Katz)
W77-06615

DYNAMICS OF MICRO-ZOOPLANKTON POPULATIONS TREATED WITH COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, California Univ., San Diego, La Jolla. Inst. of Marine Resources.
J. R. Beers, G. L. Stewart, and K. D. Hoskins.
Bulletin of Marine Science, Vol. 27(1), p. 66-79, 1977. 2 tab, 10 fig, 28 ref.

Descriptors: *Zooplankton, *Protozoa, Larvae, Biomass, *Bioassay, *Copper, On-site data collections, *Copper, *Heavy metals, Water pollution effects, Path of pollutants, *Biological communities, Monitoring, Bioindicators, Toxicity, On-site investigations.
Identifiers: *Controlled experimental ecosystem, *Micro-zooplankton, Micrometazoa.

The taxonomic composition, numerical abundance, and biomass of the microzooplankton component of natural plankton populations from Saanich Inlet, British Columbia contained in large-volume (68 cu m) Controlled Experimental Ecosystems (CEEs) were monitored during two studies on the effects of copper. Populations subjected to 50 and 10 micrograms per liter copper were examined along with two control populations in the first experiment; enclosures with copper at 10 and 5 micrograms/l and a single control were observed during the second experiment. Differences between experimental and control CEE populations were greatest at the highest copper level, decreasing with lower concentrations. The major ciliate groups dropped out of the contained ecosystem with copper introduced at 50 micrograms/l and did not reappear. Oligotrich ciliates, but with different dominant species than in the controls, developed in environments to which 5 and 10 micrograms/l copper had been added. Among the important micrometazoan taxa, naupliar copepod abundances were lower relative to the controls in 50 and 10 micrograms/l, but not 5 micrograms/l, copper-treated enclosures. The observed effects on the micro-zooplankton taxa may not be related to direct action of copper on these organisms, but may have resulted from modifications to other trophic levels of the contained populations. (Katz)
W77-06616

EVALUATION OF POTENTIAL INDICATORS OF SUB-LETHAL TOXIC STRESS ON MARINE ZOOPLANKTON (FEEDING, FECUNDITY, RESPIRATION AND EXCRETION): CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
M. R. Reeve, M. A. Walter, K. Darcy, and T. Ikeda.
Bulletin of Marine Science, Vol. 27(1), p. 105-113, 1977. 3 tab, 1 fig, 14 ref.

Descriptors: *Marine animals, *Zooplankton, Copepods, Feeding rates, Fecundity, Respiration, *Copper, *Mercury, *Heavy metals, Water pollution effects, Toxicity, *Bioindicators, Laboratory tests, *Methodology, Mortality.
Identifiers: *Controlled experimental ecosystem, *Sub-lethal effects, Fecal pellet production, Egg production, LC 50.

Fecal pellet and egg production were used as indicators of the condition of small copepods exposed to low levels of copper and mercury in the laboratory. Natural copepod assemblages in three different locations were compared in their sub-lethal responses. Although effects could be demonstrated in the 1-10 microgram/l range, many biological and chemical factors combined to make it pointless to specify toxicity levels more precisely, particularly where the aim is to extrapolate data to other situations for regulatory purposes. Species composition, season, temperature, and chemical complexing capacity of the water would all introduce variability. It is suggested that in this concentration range, the kind of metal present may be less important than the total amounts. Respiration and excretion rates of zooplankton were not found to be sensitive indicators of sub-lethal stress. (Katz)
W77-06617

THE GROWTH OF YOUNG SALMONIDS (ONCHORHYNCHUS KETA): CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, British Columbia Univ., Vancouver. Inst. of Oceanography.
P. Koeller, and T. R. Parsons.
Bulletin of Marine Science, Vol. 27(1), p. 114-118, 1977. 4 tab, 1 fig, 7 ref.

Descriptors: Salmonids, *Chum salmon, *Juvenile fish, *Fish food organisms, Zooplankton, Crustaceans, Food chains, *Copper, *Heavy metals, Water pollution effects, Growth rates, Productivity.
Identifiers: *Controlled experimental ecosystem.

The growth of juvenile chum salmon (*Onchorhynchus keta*) in full-scale (1700m³) controlled ecosystems was followed over a period of 45 days. The controlled ecosystems supported the growth of juvenile salmon when large crustacean zooplankton were present as part of the natural food chain in the enclosures. In the presence of small zooplankton the young salmon were unable to increase in weight. In contrast to the marked effect of diet on the growth of juvenile salmonids, the presence of 2.5 micrograms/l inorganic copper (10 x ambient level) caused no observable effect on the growth or survival of the fish. These experiments indicate that factors (pollutants or natural events) which alter the spectrum of prey items available to young fish may be more important than the direct effect of physical or chemical factors on juvenile fish. (Katz)
W77-06618

EXPERIMENTAL OBSERVATIONS ON THE EFFECTS OF COPPER ON COPEPODS AND OTHER ZOOPLANKTON: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
M. R. Reeve, J. C. Gamble, and M. A. Walter.
Bulletin of Marine Science, Vol. 27(1), p. 92-104, 1977. 1 tab, 7 fig, 23 ref.

Descriptors: *Zooplankton, *Copepods, Digestion, Filtration, Feeding rates, *Copper, *Heavy metals, Water pollution effects, Toxicity, Mortality, Path of pollutants, On-site data collections, Predation, *Grazing, Biological communities, Food chains.
Identifiers: *Controlled experimental ecosystem, Pseudocalanus, Calanus, Euphausia, Pleurobrachia, Fecal pellet production rates, Egg production rates.

Laboratory experiments were performed on ingestion, filtration, and fecal pellet production rates of the copepods *Pseudocalanus* sp. and *Calanus* sp. and on the feeding rates of *Euphausia* sp. and *Pleurobrachia* sp. taken from controlled environmental ecosystems to which 0, 5, and 10 micrograms/l copper had been added. In all cases, reduced activity could be demonstrated at these copper concentrations compared with populations from environmental controls. Data from sediment traps placed in the ecosystems suggested that effects of egg and fecal pellet production could also be observed. Population control by predation and grazing is also discussed. (Katz)
W77-06619

RESPONSE OF MACRO-ZOOPLANKTON POPULATIONS TO COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Woods Hole Oceanographic Institution, Mass.
V. R. Gibson, and G. D. Grice.
Bulletin of Marine Science, Vol. 27(1), p. 85-91, 1977. 3 tab, 3 fig, 9 ref.

Descriptors: *Zooplankton, *Fluctuations, Biomass, Biological communities, Sampling, Nets, On-site data collections, *Predation, Copepods, *Copper, *Heavy metals, *Water pollution effects, Toxicity, Mortality, Path of pollutants.

Identifiers: *Controlled experimental ecosystems, *Species composition, *Ctenophores, Medusae, Acartia sp., Pseudocalanus sp.

Fluctuations in zooplankton abundance and species composition are described for two copper experiments conducted in Controlled Experimental Ecosystems during 1974. Copper concentrations of 5, 10, and 50 micrograms/l were tested. The major phenomenon in both experiments was a severe reduction (>80%) in the abundance of zooplankton in all CEEs, control as well as copper polluted. A portion of the population decline was attributed to grazing by carnivorous ctenophores and medusae, making it difficult to quantitatively assess the effects of copper. The abundance of ctenophores and medusae remained higher in control than in copper perturbed CEEs, indicating that these organisms are adversely affected by the copper concentrations used in the experiments. At a nominal concentration of 50 micrograms/l copper, abundances of *Pseudocalanus* sp. and *Acartia longiremis* were reduced to 50% of their original levels 3-5 times more quickly than in the controls. Results in 5 and 10 micrograms/l CEEs were more variable and less significant. It is not known whether these effects were the direct result of copper on the organisms, or an indirect result of alterations at lower trophic levels. (Katz) W77-06620

EFFECTS OF COPPER ON SILICIC ACID UPTAKE BY A MARINE PHYTOPLANKTON POPULATION: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. Alaska Univ., College. Inst. of Marine Science. J. J. Goering, D. Boisseau, and A. Hattori. Bulletin of Marine Science, Vol. 27(1), p. 58-65, 1977. 4 tab, 21 ref.

Descriptors: *Phytoplankton, Silicates, *Copper, *Heavy metals, Water pollution effects, *Path of pollutants, *Bioassay, On-site investigation, Diatoms, Growth rates, Marine algae, Marine plants, *Silica, Plant growth, Plant physiology. Identifiers: *Controlled experimental ecosystem, *Silicic acid uptake.

Stable isotope tracer techniques were used to examine the effect of copper on silicic acid uptake by natural populations of marine phytoplankton. Short term exposures (1-6 days) of phytoplankton to four levels of added copper, 2.5, 5.0, 10.0, and 25.0 micrograms/l were studied. Copper additions, in general, inhibited uptake when compared to controls with the greatest effect at 25 micrograms/l copper. Uptakes at this copper concentration ranged from 49-98% of the control with a mean of 61% and many values near 50%. The estimated rates of dissolution of silica from phytoplankton cell walls in the presence or absence of copper were low. This implies that exposure of siliceous phytoplankton to copper up to 25 micrograms/l does not greatly alter their dissolution rate. (Katz) W77-06621

RESPONSE OF NATURAL MARINE BACTERIAL POPULATIONS TO COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. Woods Hole Oceanographic Institution, Mass. R. F. Vaccaro, F. Azam, and R. E. Hodson. Bulletin of Marine Science, Vol. 27(1), p. 17-22, 1977. 4 fig, 12 ref.

Descriptors: *Copper, *Heavy metals, *Marine bacteria, *Phytoplankton, Ions, On-site data collection, Photosynthesis, Biological communities, Succession, Resistance, *Water pollution effects, Path of pollutants, *Toxicity, Mortality. Identifiers: Enclosed marine ecosystem, Heterotrophic bacteria, *Copper ion.

The addition of Cu^{2+} at 10 and 50 micrograms/l to two enclosed marine ecosystems led to a marked increase in the relative numbers and activity of

bacterial heterotrophs. This acceleration appears to follow the release of available organic carbon from one or more copper-sensitive components of the original ecosystem. Ultimately, the bacterial survivors, which demonstrate an increased tolerance to copper with time, reciprocate by providing a source of plant nutrients suitable for the establishment of succeeding phytoplankton regimes. (Katz) W77-06622

EFFECTS OF FOUR OILS ON MARINE BACTERIAL POPULATIONS: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. California Univ., San Diego, La Jolla. Inst. of Marine Resources. R. E. Hodson, F. Azam, and R. F. Lee. Bulletin of Marine Science, Vol. 27(1), p. 119-126, 1977. 2 tab, 2 fig, 20 ref.

Descriptors: *Marine bacteria, *Microorganisms, *Oil wastes, *Oil pollution, *Water pollution effects, *Toxicity, Mortality, Resistance, On-site data collection, Carbon radioisotopes, Chemical analysis, Organic compounds. Identifiers: Controlled experimental ecosystem, Processed oil, Crude oil, Tolerance, Glucose, Mineralization, Total hydrocarbon concentration.

During the August, 1974 CEPEX (Controlled Ecosystem Pollution Experiment) hydrocarbon experiment, the effects of four oils (Louisiana crude, Kuwait crude No. 2 fuel oil, and Bunker C oil) on heterotrophic uptake and mineralization of D-glucose-14C by 1 microgram-filterable microbial populations from Saanich Inlet, British Columbia, Canada, were examined. The four oils inhibited D-glucose uptake and mineralization; the degree of inhibition was dependent upon both the oil type and concentration. The two processed oils were more toxic than the two crude oils tested. Low concentrations (e.g. 80 micrograms/l) of Bunker C oil stimulated bacterial metabolism. Populations exposed to 10 micrograms/l of No. 2 fuel oil for 30 days in CEE enclosures did not acquire oil tolerance. Neither the potential for oxidation of 14C-labeled hydrocarbons nor the total bacterial density was enhanced by one-month's exposure to 10 micrograms/l of No. 2 fuel oil. These data suggest that concentrations of these oils in seawater above 300 micrograms/l can significantly inhibit marine bacterial activity. (Katz) W77-06623

EFFECTS OF COPPER ON PHYTOPLANKTON STANDING CROP AND PRODUCTIVITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. California Univ., San Diego, La Jolla. Inst. of Marine Resources. W. H. Thomas, O. Holm-Hansen, D. L. R. Siebert, F. Azam, and R. Hodson. Bulletin of Marine Science, Vol. 27(1), p. 34-43, 1977. 1 tab, 10 fig, 27 ref.

Descriptors: *Copper, *Heavy metals, *Toxicity, *Mortality, *Water pollution effects, Phytoplankton, Productivity, Standing crops, Growth rates, Carbon radioisotopes, Photosynthesis, Food chain. Identifiers: *Controlled experimental ecosystem.

Two experiments were performed in which copper was added to seawater and its associated plankton enclosed in plastic containers moored in Saanich Inlet, British Columbia. In the first experiment (10 and 23 to 50 microgram/l copper) phytoplankton crops, photosynthesis, and growth rates were initially inhibited by copper. Excretion of 14C-labelled organic matter was high in copper-treated populations. Initial inhibition was followed by recovery of the phytoplankton crops and of photosynthesis so that, at the end of the experiment (27 days), values were similar to those in untreated control enclosures. There were no significant differences in the particulate carbon:nitrogen

or carbon:phosphorus ratios between the control and test enclosures, indicating that copper did not change the gross chemical composition of the phytoplankton. In the second experiment (5 and 10 microgram/l copper), copper seemed to increase the algal standing crops, but not the rate of photosynthesis, over levels in the control enclosure. The lack of inhibitory effects of copper might have been because the crop at the time of copper addition consisted mostly of microflagellates which were the copper-resistant algae noted in the first experiment. The slight increase in plant biomass in treated CEEs was, however, most likely due to inhibition of zooplankton which would result in reduced grazing pressure on the algal crops. (Katz) W77-06624

EFFECTS OF COPPER ON THE DOMINANCE AND THE DIVERSITY OF ALGAE: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. California Univ., San Diego, La Jolla. Inst. of Marine Resources. W. N. Thomas, and D. L. R. Siebert. Bulletin of Marine Science, Vol. 27(1), p. 23-33, 1977. 10 figs, 2 tabs, 15 ref.

Descriptors: *Copper, *Heavy metals, *Water pollution effects, *Path of pollutants, Diatoms, *Phytoplankton, Marine algae, Dinoflagellates, *Biomass, Toxicity, Mortality, On-site data collections, Bioassay. Identifiers: *Controlled experimental ecosystems, Microflagellates, Centric diatoms, Pennate diatoms, Diversity.

Two experiments were performed in which copper was added to plastic experimental enclosures (CEEs) moored in Saanich Inlet, British Columbia. In the first experiment, copper was added 1 day after mooring at concentrations of 10 and 50 micrograms per liter copper. Ten days later, populations of centric diatoms, *Chaetoceros* sp., declined as a proportion of the crop in copper treated enclosures. These populations were replaced by copper-insensitive algae (microflagellates, *Nitzschia delicatissima* and *Navicula distans*). Taxonomic diversity declined in both control and treated enclosures, but was very much lower in copper treatments. Biomass diversities also declined, but the differences between control and treated enclosures were not significant. In the second experiment, copper was added 10 days after the start at concentrations of 5 and 10 mg/l copper. Before copper addition diatoms declined proportionally and were replaced by microflagellates. Thereafter, in the control enclosure, the proportion of centric diatoms and dinoflagellates increased. Copper treatment resulted in low proportions of centric diatoms and the complete absence of dinoflagellates 4 days after copper treatment. The remaining population consisted mainly of pennate diatoms, of which *Nitzschia d.* was prominent. Taxonomic and biomass diversity declined in all enclosures prior to copper treatment; copper treatment in this experiment did not result in significant changes in either diversity measurement. These studies provide data substantiating the hypothesis that certain algae will predominate over others when pollutants are introduced into the sea. (Katz) W77-06625

TEMPERATURE, SALINITY AND LIGHT PENETRATION STRUCTURES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT. British Columbia Univ., Vancouver. Inst. of Oceanography. M. Takahashi, and F. A. Whitney. Bulletin of Marine Science, Vol. 27(1), p. 8-16, 1977. 11 figs, 15 ref.

Descriptors: *Water temperature, *Salinity, *Light penetration, *Euphotic zone, Stratification, On-site data collection, Physical properties,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

*Marine microorganisms, Cycling nutrients, Diatoms, Zooplankton, Phytoplankton, *Sea water.
Identifiers: *Controlled experimental ecosystems, *Pelagic ecosystems.

Temperature, salinity, and light penetration profiles were taken frequently during eight separate experiments in 0.25-scale controlled experimental ecosystems (CEEs), each lasting approximately 1 month, and one experiment in full-scale CEEs, lasting 2.5 months. In both scale CEEs, the temperature profiles showed similar temporal changes to those of the outside waters. Initial salinity structures were maintained throughout the experiment, except for some modification by rain and wave action, while that outside changed due to estuarine and tidal activity as well. In the 0.25-scale CEEs, waves promoted vertical mixing and, in the top 5 to 7 m, occasionally caused water exchange. The water column in the full-scale CEEs was highly stratified, preventing some organisms and regenerated nutrients from being advected into the euphotic zone. The floats and plastics of the CEEs reduced direct solar energy up to 50% and diffused the incident light. (Katz)
W77-06626

LOCH EWE BAG EXPERIMENT, 1974.
Marine Lab., Aberdeen (Scotland).
J. C. Gamble, J. M. Davies, and J. H. Steele.
Bulletin of Marine Science, Vol. 27(1), p. 146-175, 1977. 5 tab, 25 figs, 46 ref.

Descriptors: *On-site data collections, *Methodology, *Primary production, Carbon radioisotopes, Water temperature, Salinity, *Copper, *Heavy metals, Larvae, Benthic fauna, Phytoplankton, Zooplankton, Marine biology, *Cycling nutrients.
Identifiers: *Controlled experimental ecosystems, *Lock Ewe(Scotland).

The study of planktonic ecosystems in large plastic enclosures (bags) elucidates the effects of a range of factors including different rates of nutrient enrichment, variations in predator numbers, and additions of copper to the system. Differences in rates of nutrient enrichment alter the rate of primary production without greatly altering phytoplankton biomass. Variations in population structure of the phytoplankton and in herbivore biomass appear to result from differences in predator numbers. The effects of natural stresses appear similar to those induced by a pollutant. (Katz)
W77-06627

THE UPTAKE OF LEAD, ZINC, CADMIUM, AND COPPER BY THE PULMONATE MOLLUSC, HELIX ASPERSA MULLER, AND ITS RELEVANCE TO THE MONITORING OF HEAVY METAL CONTAMINATION OF THE ENVIRONMENT.
Bristol Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-06629

STABLE ELEMENTS OF RADIOECOLOGICAL IMPORTANCE IN CERTAIN ECHINODERM SPECIES.
Democritus Nuclear Research Center, Athens (Greece). Chemistry Dept.
C. Papadopoulou, G. D. Kaniaris, and E. Moraitopoulou-Kassimati.
Marine Pollution Bulletin, Vol. 7(8), p. 143-144, 1976. 2 tab, 1 fig, 14 ref.

Descriptors: *Radioecology, Neutron activation analysis, *Radio-chemical analysis, Radioisotopes, *Radioactive wastes, *Path of pollutants, Water pollution sources, Marine animals, Bioindicators, Public health, Benthos, Trace elements, Pollutant identification, Spectroscopy.

Identifiers: *Echinoderms, Gamma-ray spectroscopy, *Marine ecosystems.

Echinoderms may present variations in their elementary composition according to the surrounding medium and to their food sources. The accumulation of certain trace elements by these organisms is of radioecological interest, besides the biological one. The elements cobalt, zinc, chromium, caesium, silver, tin, iron, rubidium, selenium and scandium were determined in seven echinoderm species by neutron activation analysis and gamma-ray spectroscopy. The calculated values of the concentration factors of the determined elements are reported and discussed from the radioecological point of view. (Katz)
W77-06640

AN OFFSHORE BIOMONITORING SYSTEM FOR CHLORINATED HYDROCARBONS.
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, T. C. Heesen, and D. J. McDermott.
Marine Pollution Bulletin, Vol. 7(8), p. 156-159, 1976. 4 figs, 17 ref.

Descriptors: *Mussels, *DDT, *Polychlorinated biphenyls, *Chlorinated hydrocarbons, *Bioindicators, On-site data collections, Industrial wastes, Water pollution effects, Path of pollutants, Bottom sediments, *Methodology, Bioassay, Biochemistry, *Monitoring, Pollutant identification.
Identifiers: *Mytilus californianus, Taut-line buoy system, Submarine outfalls.

Uncontaminated intertidal mussels transferred to a tautline buoy system near a major submarine outfall off southern California proved to be useful bio-indicators of water column contamination. Mussel survival exceeded 90%, and specimens maintained for 13 weeks near the polluted bottom (35m) and the sea surface accumulated DDT above control concentrations by factors of 200 and 20, respectively. Corresponding factors for PCB were 60 and 6. (Katz)
W77-06641

COASTAL METEOROLOGICAL NETWORKS TO DETERMINE EFFECTS OF NUCLEAR PLANT COOLING SYSTEMS.
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 2B.
W77-06643

PETROLEUM HYDROCARBONS FROM EFFLUENTS: DETECTION IN MARINE ENVIRONMENT.
Hunter Coll., New York. Dept. of Environmental Health Sciences.
J. T. Tanacredi.
Journal of the Water Pollution Control Federation, Vol. 49, No. 2, p. 216-226, February 1977. 7 fig, 5 tab, 32 ref.

Descriptors: *Pollutant identification, *Oil wastes, *New York, *Water pollution sources, *Marine biology, *Oil pollution, *Waste water(Pollution), Benthos, Analytical techniques, Aquatic life, Fluorescence, Spectroscopy, Chromatography, Chemical analysis, Instrumentation, Oil, Water pollution, Oily water, Effluents, Pollutants, Organic compounds.
Identifiers: *Petroleum hydrocarbons, *Marine environments, *Crankcase wastes, *Waste oil disposal, *Jamaica Bay(NY), Marine organisms, Crankcase oil.

Weekly samples from four wastewater treatment facilities discharging into Jamaica Bay were analyzed for the presence of waste crankcase petroleum products. Two novel ultraviolet-fluorescence spectroscopic techniques were utilized to exhibit qualitatively the presence of waste

automotive petroleum hydrocarbons in each of the final effluents of water pollution control plants by comparison of sample 'profiles' to 'profiles' generated by standard oils. The surface waters and a benthic organism (*Mya arenaria*) residing in Jamaica Bay were also analyzed for petroleum hydrocarbons using these techniques. Ultraviolet-fluorescence spectroscopic analyses furnished dramatic evidence for the presence of a significant quantity of hydrocarbons associated with waste petroleum products in all samples collected. Gas chromatographic and mass spectroscopic analyses indicate petroleum contamination of mollusks. (Henley-ISWS)
W77-06660

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY.
Bendix Aerospace Systems Div. Ann Arbor, Mich. R. H. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-12434. Price codes: A02 in paper copy, A01 in microfiche. Report BSR 4201, October 1975. 11 p, 4 fig, 4 tab, 7 ref. NASA NAS5-20942.

Descriptors: *Remote sensing, *Water quality, *Lake Huron, Satellites(Artificial), *Mapping, Eutrophication, Nutrients, Chlorophyll, Phosphorus, Water temperature, Correlation analysis, Regression analysis, Data processing.
Identifiers: *LANDSAT, *Saginaw Bay(Mich).

Computer techniques developed for mapping water quality parameters from LANDSAT data were demonstrated, using ground truth collected in an ongoing survey of water quality in Saginaw Bay (Lake Huron), Michigan sponsored by the US Environmental Protection Agency. Chemical and biological parameters were collected at 27 bay stations in concert with LANDSAT overflights. Application on stepwise linear regression to 12 of these parameters and corresponding LANDSAT measurements resulted in relationships that can be applied to map any one of the 12 water quality parameters over the entire bay. The regression correlation coefficients varied from 0.99 for total phosphorus to 0.72 for chlorophyll a corrected. Five of the water quality parameters are best correlated with LANDSAT Band 6 alone. One parameter, temperature, relates to Band 5 alone, and only two bands are justified for mapping the remaining six parameters. (Sims-ISWS)
W77-06665

COMPUTER MAPPING OF LANDSAT DATA FOR ENVIRONMENTAL APPLICATIONS.
Bendix Aerospace Systems Div. Ann Arbor, Mich. R. H. Rogers, J. B. McKeon, L. E. Reed, N. F. Schmidt, and R. N. Schecter.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-13551. Price codes: A02 in paper copy, A01 in microfiche. Report BSR 4206, November 1975. 17 p, 5 fig, 9 ref. NASA NAS5-20942.

Descriptors: *Remote sensing, *Mapping, *Land use, *Water quality, Satellites(Artificial), Data processing, Watersheds(Basins), Water pollution, Water pollution sources, Runoff, Sediments, Nutrients, Classification, Land classification, Forests, Cities, Urbanization, *North Carolina.
Identifiers: *LANDSAT, Triangle J Council of Government(NC).

LANDSAT computer compatible tapes were used as a basis for inventorying land cover within the Triangle J Council of Government's 1,750 sq mi study area. Ten land cover categories were interpreted for the study area at a detail of 0.44 hectares (1.1 acres). The study area included 3 urban density categories, 4 forest types, agricultural-managed lands, bare soil-construction sites, and water. The resulting products included color-coded overlays for each of the 10 categories for a

1:96,000 scale base map, a color composite map of the same categories and scale, and a computer tape containing 54 quadrangles (7.5 minute) where each 50 meter grid cell was coded as to the 10 land cover types. This taped data is being aggregated into 4 hectare (about 10 acres) grid cells and merged with soils and slope data to compute sediment and nutrient flows in the drainage areas. The complete inventory was accomplished with a period of 60 days at a cost of less than one cent per acre, a significant improvement in dollars and time over previously reported efforts. (Sims-ISWS) W77-06666

MINERAL CONTENT OF SELECTED GEOTHERMAL WATERS,
Nevada Univ. System, Las Vegas. Water Resources Center.
For primary bibliographic entry see Field 3E. W77-06667

MONITORING GROUNDWATER QUALITY: ILLUSTRATIVE EXAMPLES.
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 936, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA 600/4-76-036, Las Vegas, Nevada, July 1976. 92 p, 18 fig, 8 tab, 37 ref, 1 append. R. M. Tinlin, editor. EPA 69-01-0759.

Descriptors: *Arkansas, *California, *New York, *Connecticut, *Arizona, *Groundwater, *Water pollution, Water resources, *Monitoring, *Water quality, Water wells, Control systems, Data collections, Industrial wastes, Nitrates, Septic tanks, Salinity, Aquifers, Leachate, Cesspools, Chemical properties, Measurement, Water supplies, Oxidation lagoons.
Identifiers: *Brine disposal, Landfill leachate, Plating wastes contamination, Percolation ponds, Agricultural pollution.

This study was designed to show by example site-specific procedures for monitoring various classes of groundwater pollution sources. The first five case histories of actual or potential groundwater pollution were presented, including the monitoring techniques and their efficacy. The case histories cover brine disposal in Arkansas, plating waste contamination in Long Island, New York, landfill leachate pollution in Milford, Connecticut, an oxidation pond near Tucson, Arizona, and multiple-source nitrate pollution in the Fresno-Clovis, California, metropolitan area. The report concluded with hypothetical illustrative examples for developing and selecting monitoring alternatives based on a cost comparison between other alternatives and hydrologic judgment. The examples illustrated cover agricultural return flow, septic tanks, percolation ponds, and landfills. (Henley-ISWS) W77-06673

THE DISTRIBUTION OF NATURAL AND ANTHROPOGENIC ELEMENTS AND COMPOUNDS IN PRECIPITATION ACROSS THE U.S.: THEORY AND QUANTITATIVE MODELS,
North Carolina Univ., Chapel Hill. Dept. of Botany.
For primary bibliographic entry see Field 2B. W77-06675

MEASUREMENTS OF PLANKTONIC BIOMASS IN A RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
D. W. Toetzel.
Available from the National Technical Information Service, Springfield, VA 22161 as ORO-425 431, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma State Univ., Dept. of Zoology Contribution 505, (1975). 9 p, 2 tab, 7 ref. AEC AT-(40-1)-4254.

Descriptors: *Reservoirs, *Plankton, *Biomass, *Measurement, *Variability, *Oklahoma, Euphotic zone, On-site investigations, Analytical techniques, Statistical methods, Pollutant identification.
Identifiers: *Lake Carl Blackwell (Okla), Melosira, Analysis of variance (ANOVA).

The assumption that planktonic biomass measurements at two nearby stations at the same euphotic zone depth would yield correlated data was tested in Lake Carl Blackwell, Oklahoma. The predominant diatom Melosira was used in the analysis of variance (ANOVA). The widest range in absolute values encountered were: 0.07-0.30 mg particulate nitrogen/l; 0.78-2.09 mg particulate carbon/l; 0.07-7.0 mg chlorophyll-a/cu m and 0.688 Melosira/ml. The only consistent pattern to emerge from two-way (ANOVA) is that station effects are an important variability source for Melosira. Three-way (ANOVA) run with sampling time as an additional variable emphasized that for Melosira station site was a significant source but sampling time was not. However, interactions between samples and time of sampling and station and time of sampling were significant. In all three chemical parameters sampling time contributed a significant source of variability. Moreover, samples x time of sampling interaction was also significant in all cases. Chlorophyll-a and particulate nitrogen tended to increase with time. Sample effects and the samples x time of sampling interactions were significant in a three-way (ANOVA) for particulate carbon and particulate nitrogen. The test results are given as a guide to research planners. (Auen-Wisconsin) W77-06679

SOME EFFECTS ON INTEGRAL PHOTOSYNTHESIS OF ARTIFICIAL CIRCULATION OF PHYTOPLANKTON THROUGH LIGHT GRADIENTS,
For primary bibliographic entry see Field 5C. W77-06696

THE USE OF REMOTE SENSING TO DETECT HOW WIND INFLUENCES PLANKTONIC BLUE-GREEN ALGAL DISTRIBUTION,
For primary bibliographic entry see Field 5C. W77-06697

INDUCTION OF HEPATIC MICROSOMAL ENZYMES BY AROCLOR 1254 IN ICTALURUS PUNCTATUS (CHANNEL CATFISH),
Texas A and M Univ., College Station. Dept. of Veterinary Physiology and Pharmacology.
For primary bibliographic entry see Field 5C. W77-06759

THE MEASUREMENT OF TEMPERATURE TOLERANCE: VERIFICATION OF AN INDEX,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C. W77-06764

WATER CHEMISTRY AND WATER QUALITY,
Uppsala Univ. (Sweden). Dept. of Physical Geography; and Uppsala Univ. (Sweden). Div. of Hydrology.
E. Eriksson.
Ambio, Vol. VI, No. 1, p 27-30, 1977 1 tab, 13 ref.

Descriptors: *Water quality, *Water chemistry, Water pollution, Water quality control, Water quality standards, Toxicity, Monitoring, *Pollutant identification, Analytical techniques.

Analytical determination of the chemical composition of water is discussed as well as the criteria for judging water quality as it is dependent upon the use of water. Water quality standards for domestic water use are particularly emphasized. A table is included which lists various contaminants and the

amounts of each allowed by several countries around the world. Water quality management and monitoring is discussed. (Chilton-ORNL) W77-06778

MEDIAN TOLERANCE LIMITS OF SOME CHEMICALS TO THE FRESH WATER FISH CYPRINUS CARPIO,
Andhra Univ., Waltair (India). Coll. of Engineering.
For primary bibliographic entry see Field 5C. W77-06780

PARTIAL EXTRACTION OF METALS FROM AQUATIC SEDIMENTS,
Geological Survey, Albany, N.Y. Central Lab.
B. A. Malo.
Environmental Science and Technology, Vol. 11, No. 3, March 1977, p 277-282, 10 tab, 1 fig, 7 ref.

Descriptors: *Separation techniques, *Metals, Sediments, Monitoring, Monitoring, Pollutant identification, Analytical techniques.

Four procedures which use 0.3 M HCl, pH 3 or pH 7 citrate-dithionite, or acetic acid-hydroxylamine solutions were evaluated with respect to their potential use in removing surface coatings from aquatic sediment particles. The 0.3 M HCl extraction required fewer manipulations than the citrate-dithionite procedure, yielded approximately the same recovery efficiency with minimum structural degradation, and resulted in an easily analyzed solution. These advantages make the 0.3 M HCl procedure preferable for routine use in monitoring the readily acid-soluble minor elements in aquatic sediments. (Chilton-ORNL) W77-06781

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL,
Israel Oceanographic and Limnological Research Ltd., Haifa. Haifa Labs.
For primary bibliographic entry see Field 5C. W77-06782

A PRELIMINARY SURVEY OF MERCURY IN FISH FROM BOMBAY AND THANA ENVIRONMENT,
Institute of Science, Bombay (India). Inorganic and Nuclear Chemistry Lab.
For primary bibliographic entry see Field 5C. W77-06785

INDICATOR VALUES OF VASCULAR PLANTS IN CENTRAL EUROPE, (IN GERMAN),
Goettingen Univ. (West Germany). Systematisches-Geobotanisches Institut.
For primary bibliographic entry see Field 2I. W77-06803

A COMPREHENSIVE PLAN FOR THE GLOBAL INVESTIGATION OF POLLUTION IN THE MARINE ENVIRONMENT AND BASELINE STUDY GUIDELINES.
United Nations Educational Scientific and Cultural Organization, Paris (France).
UNESCO, Intergovernmental Oceanographic Commission, Technical Series, No. 14, 1976. 42 p, 4 tab.

Descriptors: *Water pollution, *Baseline studies, *Resources development, *Environmental effects, Water pollution effects, Oceans, Pollutant identification, Monitoring, *Comprehensive planning.
Identifiers: *Outer Continental Shelf, Mass balance, Transfer processes, Marine pollution, Biogeochemical cycle, Pollution monitoring.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

This report is an amalgamation of a document entitled 'A Comprehensive Plan for a Global Investigation of Pollution in the Marine Environment', and a document entitled 'Report of the IOC/ICES Working Group on Baseline Study Guidelines', as amended by the IOC Executive Council at its seventh session in Bergen, June 1976. The GIPME Comprehensive Plan provides an international framework within which national and regional programs on various aspects of marine pollution may be coordinated to contribute to an understanding of global pollution problems. The ultimate objective of a comprehensive investigation of marine pollution is to provide a sound scientific basis for the assessment and regulation of the pollution problem, including sensibly planned and implemented monitoring programs. Equal priority is given to a number of research activities dealing with inputs, pathways, sinks, effects and dose/response relationships. Baseline studies will provide valuable data on inputs, distributions and pathways, and to some degree will help the mass-balance studies. (Sinha-OEIS) W77-06850

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA, National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office. For primary bibliographic entry see Field 5C. W77-06875

HIGH SEAS OIL POLLUTION: PARTICULATE PETROLEUM RESIDUES IN THE NORTH ATLANTIC, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab. For primary bibliographic entry see Field 5B. W77-06911

NASA DEVELOPS WATER MONITORING SYSTEM, Boeing Aerospace Co., Seattle, Wash. A. Jeffers, and R. E. Taylor. Water and Sewage Works, Vol. 124, No. 3, p 76-80, March 1977. 1 tab, 4 fig.

Descriptors: *Monitoring, *Sewage effluents, *Automation, Sampling, Analysis, Data Processing, Computers, Instrumentation, Equipment, On-site data collections, Pollutants, Sewage, Oxygen demand, Hydrogen ion concentration, Hardness(Water), Ions, Dissolved oxygen, Turbidity, Nitrates, Water pollution, Water treatment, Pollutant identification. Identifiers: *Sensors, Water monitor systems.

The National Aeronautics and Space Administration has undertaken the task to develop an automatic water quality monitoring system that can assure conformance to projected high effluent quality standards and result in an increase and acceleration in the practice of reclamation and reuse of water. The objective of this water quality monitoring program was to develop a system which includes the necessary sensors, sample collection system, and data acquisition and display system to monitor in 'real time' the effluent discharge from waste treatment plants and to provide the data which determines the quality of the wastewater. The WMS (water monitor system) was installed in a mobile trailer which houses the DAS (data acquisition system), sensors, sample conditioning/distribution system, and the report generation system. The system can be integrated with a maximum of 40 water quality sensors. The major elements which comprise the WMS were described. (Sims-ISWS) W77-06912

DISSOLVED NITROGEN, DISSOLVED OXYGEN AND RELATED WATER TEMPERATURES IN THE COLUMBIA AND LOWER SNAKE RIVERS, 1965-1969, National Marine Fisheries Service, Seattle, Wash. For primary bibliographic entry see Field 5C. W77-06925

IDENTITY, ORIGIN AND DEVELOPMENT OF OFF-FLAVORS IN GREAT LAKES ANADROMOUS FISH, Wisconsin Univ.-Madison. R. C. Lindsay. Wisconsin Department of Natural Resources, Madison Completion Report for Project AFC-13, for the period July 15, 1974 to June 30, 1976, February 1977. 7 p. PL-89-304, Proj AFC-13.

Descriptors: *Oil pollution, *Pollutant identification, Wisconsin, Great Lakes, *Anadromous fish, Lake Michigan, Fish, *Salmon, Aromatic compounds, *Taste, *Organoleptic properties, Polychlorinated biphenyls. Identifiers: Phthalate esters, *Aromatic hydrocarbons, Volatile compounds, *Flavors(Fish).

The principal effort has been directed towards the chemical identification of volatile compounds present in Great Lakes salmon and environmentally related materials. Volatile compounds were collected from samples using vacuum and atmospheric steam distillations with subsequent ether extractions. Aroma concentrates obtained from the recovery procedures were subjected to high resolution gas chromatographic analysis and mass spectrometry. Compounds with potent and distinctive odors and/or structures which indicated that the substances were different from those routinely encountered in most foods were identified. The occurrence of a number of aromatic hydrocarbons along with the aliphatic even-carbon numbered hydrocarbons would strongly suggest salmon pick-up of oil or petroleum-based product contamination materials. The identification of polychlorinated biphenyl compounds indicates that compounds of relatively low degrees of chlorination are currently present in salmon along with other compounds exhibiting greater chlorination of the biphenyl ring system. (NOAA) W77-06931

BLANK AND SALINITY CORRECTIONS FOR AUTOMATED NUTRIENT ANALYSIS OF ESTUARINE AND SEA WATERS, New Hampshire Univ., Durham. T. C. Loder, and P. M. Glibert. Sea Grant Program Report No. UNH-SG-JR-101, Dec 1976. 32 p, 8 fig, 6 tab, 34 ref. Also as: Woods Hole Oceanographic Inst. Contribution No. 3897. SG-4-2037 R/EM-2.

Descriptors: *Estuaries, *Sea water, *Nutrients, *Salinity, Measurement, *Pollutant identification, Methodology, Analytical techniques.

Routine measurements of dissolved micronutrients in sea water are performed by numerous laboratories using a Technicon Auto Analyzer II System. The methods employed are generally the Technicon Industrial Methods with various modifications. Experimentation has shown, however, that there are some problems with these methods in the determination of blanks, which can cause significant errors in estuarine or sea water samples. The blank problems result from: (1) the index of refraction of the sea water sample, (2) reaction products of various wetting agents and sea water, (3) the absorbance of colored substances in the sample, either particulate or dissolved, and (4) the salt error or variable production of reaction products of the nutrient in the sample and the color reagents as a function of sample salinity. In this paper several methods are recommended for determining the blank and salt correction factors. The method to be used depends on the nature of the samples (fresh, estuarine or

sea water) and the nutrient being analyzed. (NOAA) W77-06938

ADENOSINE TRIPHOSPHATE (ATP) LEVELS IN MICROBIAL CULTURES AND A REVIEW OF THE ATP BIOMASS ESTIMATION TECHNIQUE, Canada Centre for Inland Waters, Burlington (Ontario). A. A. Qureshi, and J. Patel. Scientific Series No. 63, 1976, 33 p., 9 fig., 10 tab., 101 ref., append.

Descriptors: *Bacteria, *Fungi, *Biomass, Analysis, Microorganisms, Assay, Technology, *Pollutant identification, Analytical techniques, Bioassay, Reviews, Cultures, Microbiology, Estimating. Identifiers: *Adenosine triphosphate.

In laboratory-grown cultures of a lake bacterium and three lake fungi, the concentration of cellular ATP was found to vary appreciably during the various stages of growth. Generally, the highest level of ATP was observed during the lag and early log growth phases. Thereafter, the ATP concentration rapidly decreased and stabilized at a relatively constant level during the stationary phases of the growth cycle. With respect to the use of the DuPont Biometer for ATP determinations, it was observed that after calibration and strict adherence to procedure during analysis, relatively consistent results could be obtained with both standard ATP solutions and test solutions. Of the various solvents examined for determining the stability of the standard ATP, boiling Tris-HCl buffer (0.02M, pH 7.75) was the best solvent. This solvent also proved to be highly satisfactory for the extraction of ATP from bacterial and fungal cultures used in this investigation. The report also provides background information on the ATP biomass estimation technique, general remarks on the technique, and an extensive bibliography of its use and application in diverse systems. (WATDOC) W77-06942

AUTOMATED METHOD FOR THE DETERMINATION OF THE PHOSPHORUS CONTENT OF DETERGENTS, Environmental Protection Service, Ottawa (Ontario). Chemistry Lab. N. L. Cathcart. Regulations, Codes and Protocols Report EPS 1-WP-76-1, December, 1976, English and French, 6 p., 1 fig., 2 ref.

Descriptors: *Phosphorus, *Detergents, *Automation, Methodology, Sampling, *Canada, Regulation, Legislation, Water quality standards, *Pollutant identification. Identifiers: *Canada Water Act Regulations, Regulations.

An experiment to determine the phosphorus content of laundry detergents is described. The particular method is used to monitor phosphorus levels pursuant to the Canada Water Act Regulations. (WATDOC) W77-06944

BURNING WASTE CHLORINATED HYDROCARBONS IN A CEMENT KILN, St. Lawrence Cement Co., Mississauga, (Ontario). For primary bibliographic entry see Field 5E. W77-06946

RECONNAISSANCE OF THE WATER RESOURCES OF THE CLINTON QUADRANGLE, WEST-CENTRAL OKLAHOMA, Geological Survey, Oklahoma City, Okla. Water Resources Div. For primary bibliographic entry see Field 7C. W77-06959

MEASUREMENT IN A MARINE ENVIRONMENT USING LOW COST SENSORS OF TEMPERATURE AND DISSOLVED OXYGEN, National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service; and Geological Survey, Edgewater, Md. Water Resources Div.
For primary bibliographic entry see Field 7B.
W77-06960

DETERMINATION OF FREE FORMIC AND ACETIC ACIDS BY GAS CHROMATOGRAPHY USING THE FLAME IONIZATION DETECTOR, Geological Survey, Lakewood, Colo. Water Resources Div.
W. R. White, and J. A. Leenheer.
Journal of Chromatographic Science, Vol 13, p 386-389, August 1975. 3 fig, 1 tab, 21 ref.

Descriptors: *Chemical analysis, *Acids, *Aqueous solutions, *Gas chromatography, *Analytical techniques, Waste disposal, Injection wells, Path of pollutants, Groundwater movement, Sampling, Water wells, *Pollutant identification. Identifiers: *Formic acid, *Acetic acid, *Flame ionization detector.

Formic and acetic acids in aqueous solution are analyzed by gas chromatography using the flame ionization detector. A specially conditioned four-foot glass column packed with Porapak Q coated with 3% phosphoric acid is used. The lower detectable limits for formic and acetic acids in solution are 100 micrograms respectively. By combining steam distillation and concentration steps, concentrations of 1.0 mg/liter of formic acid and 0.03 mg/liter of acetic acid can be measured. (Woodard-USGS)
W77-06961

HYDROCHEMISTRY OF THE LAKE MAGADI BASIN, KENYA, Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 2K.
W77-06967

PRELIMINARY ASSESSMENT OF THE WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON, Geological Survey, Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-06971

CHARACTERIZATION OF SOLUBLE ORGANIC MATTER IN LEACHATE, Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. S. K. Chian, and F. B. DeWalle.
Environmental Science and Technology, Vol 11, No 2, p 158-162, February, 1977. 4 fig, 2 tab, 26 ref.

Descriptors: *Pollutant identification, *Leachates, Analysis, Physical characteristics, Chemical characteristics, *Filtration, Membranes, *Organic matter, *Chromatography, Lipids, Separation techniques, Water pollution, Groundwater. Identifiers: Organic matter analysis, Membrane ultrafiltration.

Membrane ultrafiltration, gel permeation chromatography, and specific organic analyses were used to determine the composition of unknown major organic fractions in leachate. Results indicated that a major fraction of organics permeated a 500-MW membrane in ultrafiltration and most were present as free volatile fatty acids. The second largest fraction was a fulvic-like material with relatively high carboxyl and aromatic hydroxyl group density. A high-molecular-weight, humic carbohydrate-like complex, with a significant amount of hydrolyzable amino acids, was a small

percentage of the organics. In tests, 75% of organic matter was identified. Lipids associated with the high-molecular-weight humic fraction were indicated by solvent extraction. Aromatic hydroxyl compounds were extracted with butanol. Data indicated that universal bacterial processes might govern the character of naturally occurring organics. (Collins-FIRL)
W77-07039

FORMS OF SULFUR IN SEWAGE SLUDGE, Purdue Univ., Lafayette, Ind. Dept. of Agronomy. L. E. Sommers, M. A. Tabatabai, and D. W. Nelson.
Journal of Environmental Quality, Vol 6, No 1, p 42-46, January-March, 1977. 7 tab, 21 ref.

Descriptors: *Pollutant identification, *Sulfur compounds, *Sludge, Analysis, Heavy metals, Carbon, Nitrogen, Phosphorus, Cadmium, Organic wastes, Waste disposal, Inorganic compounds, *Sewage sludge.

An analysis was undertaken to determine the forms and amounts of organic and inorganic components of elements composing sludge. Bulk sludge samples from eleven Indiana treatment plants were subjected to gravimetric and titrimetric determinations, to a modified semimicro-Kjeldahl procedure, and to steam distillation, acidimetric titration, colorimetric determination, and various metal analyses. The samples were from plants using anaerobic digestion and either activated sludge or trickling filter secondary treatment procedures. It was found that total sulfur ranged from 0.7-2.1% and that 1-27% of this was inorganic sulfur extractable with 0.1M LiCl. Sulfur was composed of sulfide sulfur (less than 1 to 35%), inorganic nonsulfate sulfur (18-53%), carbon-bonded sulfur (18-56%), ester sulfate sulfur and inorganic sulfate sulfur (0-35%), and unidentified organic sulfur (0-42%). These forms were found to vary with time and no consistent relationships were found between the amounts of organic carbon, nitrogen, sulfur and phosphorus in the sludges. It was determined that the amounts of lead and zinc were significantly correlated with sulfide sulfur, as was cadmium with organic sulfur, ester sulfate sulfur, and 0.1M LiCl extractable sulfur. No such relationships were found for other metals and various sulfur fractions. (Collins-FIRL)
W77-07044

DRUGS AND DRUG METABOLITES AS ENVIRONMENTAL CONTAMINANTS: CHLOROPHENOXYISOBUTYRATE AND SALICYLIC ACID IN SEWAGE WATER EFFLUENT, Veterans Administration Hospital, Kansas City, Mo.
C. Hignite, and D. L. Azarnoff.
Life Sciences, Vol 20, No 2, p 337-342, January, 1977. 1 fig, 1 tab, 9 ref.

Descriptors: *Water pollution sources, *Chemical analysis, *Analytical techniques, *Pollutant identification, Waste identification, Sewage effluents, Potable water, Gas chromatography, Mass spectrometry, Waste water treatment. Identifiers: Drugs, Metabolites, Salicylic acid, 2-(4-chlorophenoxy)-2-methylpropanoic acid (CPIB).

Effluent of the Big Blue River Sewage Treatment Plant, Kansas City, Missouri, was analyzed to determine the content of drugs or drug metabolites. Composite 24-hour samples were collected and extracted under acidic, neutral, and basic conditions with methylene chloride. The extracts were screened by gas chromatography-mass spectrometry. Results indicated the presence of 2-(4-chlorophenoxy)-2-methylpropanoic acid (CPIB), the active metabolite of clofibrate, a hypolipidemic drug; and 2-hydroxy benzoic acid (salicylic acid), a metabolite of aspirin. Average 24-hour discharges of CPIB from August, 1975 to

May, 1976 were 2.1 kilograms/day and salicylic acid discharges for the same period were 8.64 kilograms/day. Concentrations in raw sewage for CPIB were 2.8 kilograms/day. Raw sewage concentrations of salicylic acid were much higher and a 90% removal of this metabolite was shown from the data. Neither compound was detected in drinking water. Further investigations for drugs in water were suggested. (Collins-FIRL)
W77-07045

THE CHEMICAL CHARACTERISTICS OF THE CITY OF WINNIPEG WASTE WATER, Winnipeg Waterworks, Waste, and Disposal Div. (Manitoba).
W. D. Carroll, and P. C. Lee.
Chemistry in Canada, Vol. 29, No. 1, p 14-17, January, 1977. 3 fig, 8 tab.

Descriptors: *Pollutant identification, Analysis, *Monitoring, *Chemical properties, Sludge treatment, Sewage treatment, Treatment facilities, Activated sludge, Oxygen, Oxidation lagoons, Heavy metals, Organic matter, Nutrients, Biochemical oxygen demand, Domestic wastes, Industrial wastes, Waste water treatment, *Canada. Identifiers: *Winnipeg (Canada).

The City of Winnipeg, Canada, uses a conventional sewage treatment plant, a pure oxygen activated sludge plant, and conventional stabilization ponds to provide secondary treatment of waste water. Industrial wastes are about 35% of the 55 mgd influent volume at the conventional plant. The oxygen activated sludge plant has an inflow of 10 mgd, which is primarily domestic sewage. The lagoon system handles about 5 mgd of domestic sewage in three primary cells. The city monitors treatment by characterizing the levels and variations of organics, nutrients, and heavy metals loadings. Analyses are made of suspended solids, grease, BOD, TOC, NH₃, NO₃, TKN, total phosphorus, copper, nickel, zinc, chromium, lead, and cadmium. TOC was used as a tool for predicting BOD in raw waste water because it provides a close approximation of potentially oxidizable carbonaceous content of samples. Nutrient levels of sewage with a significant industrial component were about equal to that of raw waste water. Chromium, zinc, lead, and nickel levels from industrial sources probably could be reduced to levels equal to that of domestic sewage. About 50-85% of the metal content ended up in the sludge, except for nickel which is removed at much lower rates. The metal content of effluents was low when compared to drinking water criteria. These analyses provide some data needed to assess the character and extent of contaminants, and the most cost-effective approach to control them. (Collins-FIRL)
W77-07047

ESCHERICHIA COLI AS A SANITARY-INDICATOR MICROORGANISM, (IN RUSSIAN), G. G. Mirzoev.
Gig Sanit 1, p 86-88, 1976.

Descriptors: *E. coli, *Bioindicators, *Microorganisms, *Pollutant identification, Public health, Human diseases, Epidemiology. Identifiers: Pathogenic microorganisms.

E. coli is not considered a suitable index for the sanitary evaluation of water, milk, milk products and other food products. E. coli is ubiquitous; its presence does not indicate fecal contamination since it makes up only 2-3% of the fecal microflora. A 5 yr analysis of sanitary microbiological laboratories showed 2.3 and 9.3% deviations from coli-titer standards. No significant correlation was established between the coli-titer and the epidemiological state of an area, even in a case of dysentery. Sanitary microbiological studies should be directed at the detection of carriers of pathogenic microorganisms and workers with chronic disease at water works, in the milk and

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

meat industry, and in other food-related jobs.--
Copyright 1977, Biological Abstracts, Inc.
W77-07067

QUANTITATIVE ANALYSIS OF ENTEROVIRUSES IN WATER WITH VARIOUS DEGREES OF POLLUTION, (IN RUSSIAN), Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of General Hygiene. V. I. Zotova, and L. A. Myshlyayeva. Gig Sanit 3, p 63-65, 1976.

Descriptors: *Pollutant identification, *Adsorption, Resins, *Ion exchange, Water pollution, *Viruses, *Water analysis, Chlorination.
Identifiers: *Enteroviruses, Picornavirus, Poliovirus.

A test of the adsorption capacity of the ion-exchange resin AV-17 in the chemical method of virus concentration and the efficacy of the resin in quantitative analysis indicated that the adsorption capacity is inversely proportional to the degree of water pollution. The vaccine strain poliomyelitis virus LSC was used as a model. The use of conversion factors increased the accuracy of quantitative analysis of test water samples. Primary cultures of monkey kidney cells were used to assay the virus. In a practical application 67 water samples from open reservoirs and 80 sewage water samples were tested for degree of purification. Cytopathic agent composition in river water was 15-30 virus particles/l; untreated sewage water contained 980-2320 plaque forming units (PFU)/l, reduced to 660-1200 PFU/l by mechanical and biological purification and 100-350 PFU/l by chlorination.--Copyright 1977, Biological Abstracts, Inc.
W77-07070

WATER QUALITY SIMULATION OF TAHOE-TRUCKEE SYSTEM, NEVADA-CALIFORNIA-VOLUME I, Nevada Univ., Reno. Desert Research Inst. For primary bibliographic entry see Field 5B.
W77-07075

WATER QUALITY INVESTIGATIONS IN THE SOUTH PLATTE RIVER BASIN, COLORADO, 1971-72. National Field Investigations Center, Denver, Colo. Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 912. Price codes: A12 in paper copy, A01 in microfiche. EPA Report 1972. 266 p, 30 fig, 17 ref, 9 append.

Descriptors: *Pollutant identification, *Water quality, Analysis, *Rivers, *Streams, Water pollution sources, Pollution abatement, Treatment facilities, Municipal wastes, Industrial wastes, Evaluation, *Colorado.
Identifiers: *South Platte River Basin(Colo).

Stream surveys were conducted of the South Platte River Basin (Colorado) to determine water quality changes since a survey in 1964-65. Surveys were made of Bear Creek, Clem Creek, Boulder Creek, St. Vrain Creek, the Big and Little Thompson Rivers, Cache la Poudre River, and the South Platte River. Twenty-three municipal waste treatment facilities were evaluated, as were industrial pollution sources. Developments in the control of industrial wastes since the earlier survey were evaluated as well. (Collins-FIRL)
W77-07076

THE ELECTROLYTIC RESPIROMETER-II. USE IN WATER POLLUTION CONTROL PLANT LABORATORIES, Iowa State Univ., Ames. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D.
W77-07081

CONCENTRATION AND DETERMINATION OF TRACE ORGANIC POLLUTANTS IN WATER, Iowa State Univ., Ames. R. C.-Y. Chang. Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 77-1019. PhD Thesis, 1976, 89 p.

Descriptors: *Pollutant identification, *Analytical techniques, *Trace elements, *Phenols, Chlorination, Oxidation, Resins, Anion exchange, Chemical reactions, Gas chromatography, Chlorides, Organic matter, Water treatment, *Waste water treatment.

A method was developed for concentrating and determining phenols in natural water, treated potable water and waste water. Determination was by selective sorption on a macroreticular anion-exchange resin and elution with acetone-water. Concentration was by evaporation after extraction with methylene chloride; measurements were performed by gas chromatography. The techniques used for preventing phenol loss due to chlorination, oxidation, and other reactions during determination were presented. Recovery was excellent for samples with model organic compounds of various classes added to water. Volatile and less volatile gas chromatographic compounds were determined. Removal of organic components in potable water was possible by this sorption method. A rapid method for determining and concentrating halomethanes in potable water was developed. (Collins-FIRL)
W77-07098

5B. Sources Of Pollution

ZOOPLANKTON SAMPLING VARIABILITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5A.
W77-06615

PARTICLE CHARACTERISTICS AND DISPERSAL PATTERNS OF SUGAR CANE WASTES IN SELECTED RIVERS AND ESTUARIES OF PUERTO RICO, Puerto Rico Univ., Mayaguez. Water Resources Research Inst. D. J. Morelock, and K. Grove. Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 907. Price codes: A04 in paper copy, A01 in microfiche. Completion Report, February 1976. 45 p, 19 fig, 8 tab, 6 ref. OWRT A-042-PR(1).

Descriptors: *Sugarcane, Streams, Estuaries, Bays, *Organic wastes, Sediments, Carbon, *Puerto Rico, Sediment distribution, Dispersal, Path of pollutants, Water pollution sources, Rivers, Waste disposal.
Identifiers: Anasco River(PR) Anasco Bay(PR).

The lower 2.5 km of the Anasco River is an estuary. Salt wedge movement is dependent on river discharge. The average position is 1 km upstream. The river empties onto the narrow insular shelf of Anasco Bay. The shelf edge is marked by a line of submerged coral reefs 1.5 km. offshore. The salt wedge has a profound influence on sedimentation in the river. In the estuary, sediments are fine grained, poorly sorted clayey silt to silty sand. Above the estuary, there are coarser sands and gravel. The organic content of sediments below the sugar mill during production is over 90%. Downstream, organic content is low and the organic debris is much finer. The traction and siltation load and part of the suspension load is deposited at the salt wedge head and in the estuary due to flocculation at the mixing boundary. Sediments in the bay are derived from coral reefs, alluvial plain shore erosion and from the discharge of the river. These are mixed with relict sediments

deposited during the lowered Wisconsin sea level. The two major facies are carbonate reef deposits and terrigenous sediments. Each of the facies and the distribution of organic debris can be correlated with the topography, current and wave patterns, and general physical characteristics of the shelf area. The results of the study indicate that estuaries are poor disposal sites for organic pollutants. Most of the wastes are deposited in the estuary and remain there for long periods. They are only partly removed during periods of high river discharge.
W77-06632

CHLORINE REACTIONS WITH SEAWATER CONSTITUENTS AND THE INHIBITION OF PHOTOSYNTHESIS OF NATURAL MARINE PHYTOPLANKTON, California Univ., San Diego, La Jolla. Inst. of Marine Resources. For primary bibliographic entry see Field 5C.
W77-06637

THE FAUNA OF THE POLLUTED RIVER TEES ESTUARY, Leeds Univ. (England). Wellcome Marine Lab. For primary bibliographic entry see Field 5C.
W77-06638

AN OFFSHORE BIOMONITORING SYSTEM FOR CHLORINATED HYDROCARBONS, Southern California Coastal Water Research Project, El Segundo. For primary bibliographic entry see Field 5A.
W77-06641

MIXING IN UPPER LAYER OF A LAKE DURING HEATING CYCLE, Institute of Oceanographic Sciences, Wormley (England). For primary bibliographic entry see Field 2H.
W77-06649

SEDIMENT YIELD PREDICTION BASED ON WATERSHED HYDROLOGY, Agricultural Research Service, Temple, Tex. For primary bibliographic entry see Field 4D.
W77-06656

CHEMICAL QUALITY OF EFFLUENTS AND THEIR INFLUENCE ON WATER QUALITY IN A SHALLOW AQUIFER, Los Alamos Scientific Lab., N. Mex. W. D. Purtyman, J. R. Buchholz, and T. E. Hakonsen. Journal of Environmental Quality, Vol. 6, No. 1, p 29-32, January-February 1977. 2 fig, 4 tab, 5 ref. ERDA W-7405-ENG.36.

Descriptors: *New Mexico, *Water quality, *Alluvial aquifers, *Waste water disposal, Effluents, Water pollution sources, Chemicals, Aquifers, Data collections, On-site investigations, Evaluation, Storm runoff, Hardness(Water), Fluorides, Calcium, Carbonates, Sodium, Nitrates, Chlorides, Bicarbonates, Magnesium, Specific conductivity, Hydrogen ion concentration.
Identifiers: *Mortandad Canyon(NM), Dilution ratios, Total dissolved solids.

The chemical quality of liquid effluent released from an industrial waste treatment plant at the Los Alamos Scientific Laboratory controls the quality of water in a shallow aquifer in the alluvium of Mortandad Canyon. The dilution of the effluent with surface flow in the canyon reduces the concentrations of the chemicals as they move down gradient into the aquifer. Mass estimates of residual chemicals in solution in the aquifer average 1-6% of the total chemicals released to the canyon from 1963-1974. The average annual con-

centration of sodium, nitrate, chloride, and total dissolved solids in the aquifer through a 12-year period was directly correlated with annual average concentrations in the effluent. This relationship provides a means of predicting the impact of the chemical effluents on the quality of water in the aquifer. Chemical concentrations in solution in the aquifer have increased over prerelease levels; however, there has not been a steady accumulation of these materials in the water with time. The rapid loss of water and its associated chemicals from the aquifer prevents chemical accumulation and indicates that cessation of effluent release to the canyon would rapidly improve the quality of water in the aquifer. (Humphreys-ISWS)
W77-06658

PETROLEUM HYDROCARBONS FROM EFFLUENTS: DETECTION IN MARINE ENVIRONMENT.
Hunter Coll., New York. Dept. of Environmental Health Sciences.
For primary bibliographic entry see Field 5A.
W77-06660

COMPUTER MAPPING OF LANDSAT DATA FOR ENVIRONMENTAL APPLICATIONS.
Bendix Aerospace Systems Div. Ann Arbor, Mich.
For primary bibliographic entry see Field 5A.
W77-06666

AN ESTIMATE OF THE INPUT OF ATMOSPHERIC TRACE ELEMENTS INTO THE NORTH SEA AND THE CLYDE SEA (1972-3).
Atomic Energy Research Establishment, Harwell (England).
R. S. Cambray, D. F. Jefferies, and G. Topping.
AERE-R 7733, January 1975. 30 p, 4 fig, 10 tab, 39 ref, 2 append.

Descriptors: *Water pollution sources, *Oceans, *Atmosphere, *Trace elements, *Sampling, Rain water, Sea spray, Analytical techniques, Evaluation, Data collections, On-site investigations, Heavy metals, Foreign countries.
Identifiers: *North Sea, *Clyde Sea (Scotland), Dry deposits.

Samples of airborne dust, rainwater, and dry deposit were collected at five coastal stations in the United Kingdom, from a Gas Platform in the North Sea and at a coastal station in North Holland. Estimates were made of the atmospheric input of trace elements into the North Sea and Clyde Sea, and comparisons were made with the estimated content of these seas. It was shown that the atmosphere is a significant source for certain heavy metals and other trace elements. The estimates of dry deposit were generally less than half those for deposition by rain which, because the rain-collecting funnel was continuously exposed, includes a component of dry deposition. A maritime effect, expressed by increased concentrations of trace elements in rainwater collected in the presence of sea-spray, was discussed in an appendix and attributed to a massive enhancement of trace elements in the surface microlayer of the sea. An estimate of the amount of precipitation over the sea was also given and discussed in an appendix. (Humphreys-ISWS)
W77-06668

MONITORING GROUNDWATER QUALITY: ILLUSTRATIVE EXAMPLES.
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 5A.
W77-06673

LAKE CURRENTS AND TEMPERATURES NEAR THE WESTERN SHORE OF LAKE MICHIGAN.
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.

For primary bibliographic entry see Field 2H.
W77-06687

THE MINING FAUNA IN FOUR MACROPHYTES SPECIES IN MIKOLAJSKIE LAKE.
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
For primary bibliographic entry see Field 5C.
W77-06688

THE GENERATION OF RESIDUAL FLOWS IN NORWAY: AN INPUT-OUTPUT APPROACH.
Oslo Univ. (Norway). Inst. of Economics.
For primary bibliographic entry see Field 5G.
W77-06698

OPTIMAL OIL TANKER SIZE WITH REGARD TO ENVIRONMENTAL IMPACT OF OIL SPILLS.
California Univ., Los Angeles. Graduate School of Management.
For primary bibliographic entry see Field 5G.
W77-06702

THE HISTORIC AND PRESENT RELATIONSHIPS BETWEEN PHYTOPLANKTON, LIMITING NUTRIENTS, AND SEDIMENT-WATER GEOCHEMICAL PROCESSES IN SELECTED MAINE LAKES.
Maine Univ. at Orono. Land and Water Resources Inst.
For primary bibliographic entry see Field 5C.
W77-06741

POLLUTANT MOVEMENT TO SHALLOW GROUND WATER TABLES FROM SWINE WASTE LAGOONS.
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
T. G. Ciravolo, D. C. Martens, D. L. Hallock, E. R. Collins, Jr., and E. T. Kornegay.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 052.
Price codes: A04 in paper copy, A01 in microfiche.
Virginia Water Resources Research Center, Blacksburg, Bulletin 100, March 1977. 61 p, 7 fig, 21 tab, 32 ref. OWRT B-068-VA(1).

Descriptors: *Path of pollutants, Water pollution sources, Hogs, *Groundwater movement, Waste disposal, *Farm lagoons, Clays, *Farm wastes, *Seepage, Monitoring, Nutrients, Water tables, Bacteria, Drainage, *Virginia, Coastal Plains, Anaerobic conditions.
Identifiers: *Swine-waste lagoons, Soluble nutrients.

The effect of three anaerobic swine-waste lagoons on the quality of nearby ground water was investigated. The lagoons, in the Coastal Plain region of Virginia, were located on soils with high water tables and with varying drainage characteristics. Over a 14-month period in 1974 and 1975, ground water samples were taken from wells located at various depths and distances from the lagoons. These samples were analyzed to determine the extent of contamination due to the lagoons. The biological constituent analyzed was the number of fecal coliform bacteria; chemical constituents analyzed were concentrations of Cl, Cu, Mn, NH₄-N, NO₃-N, PO₄-P, and Zn. Research findings showed that the quality of ground water was affected least around one lagoon constructed at ground level in a poorly drained soil with a clay subsoil. No ground water contamination was found more than 3 m from this lagoon. In contrast, ground water around two lagoons constructed with embankments above ground level, one in a sandy clay loam subsoil and the other in a sandy subsoil, showed traces of swine-waste components as far away as 30 m. Pollutant levels in ground water around the former lagoon were below U.S. Public Health Service drinking water

standards, while pollutant levels around the latter lagoon exceeded those standards on many occasions. These experimental results indicate that seepage may occur from lagoons with embankments above ground level in sandy soil, and that biological sealing in such lagoons may not sufficiently protect shallow aquifers from contamination.
W77-06742

LONG-TERM CHANGES OF THE PELAGIC PRIMARY PRODUCTION IN HEATED LAKES, (IN POLISH).
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06755

THE INFLUENCE OF HEATED EFFLUENT WATERS ON THE THERMAL-OXYGEN RELATIONS AND WATER TRANSPARENCY IN THE KONIN LAKES COMPLEX, (IN POLISH).
Instytut Rybactwa Środladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-06756

ADSORPTION OF POLYCHLORINATED BIPHENYL (AROCLO 1254) ON SHRIMP.
Louisiana State Univ., Baton Rouge. Dept. of Food Science.
For primary bibliographic entry see Field 5C.
W77-06758

THE ALGAL FLORA IN THE THERMAL BATHS OF MONTEGROTTO TERME (PADUA). ITS DISTRIBUTION OVER ONE-YEAR PERIOD.
Padova Univ. (Italy). Istituto di Botanica e Fisiologia Vegetale.
For primary bibliographic entry see Field 5C.
W77-06770

DISPERSAL AND DISPERSION OF POND SNAILS IN AN EXPERIMENTAL ENVIRONMENT VARYING TO THREE FACTORS, SINGLY AND IN COMBINATION.
Iowa Univ., Iowa City. Dept. of Zoology; and Iowa Univ., Iowa City. Lakeside Lab.
For primary bibliographic entry see Field 5C.
W77-06773

LONG-TERM LEAD ACCUMULATION IN ABALONE (HALIOTIS SPP.) FED ON LEAD-TREATED BROWN ALGAE (EGREGIA LAEVIGATA).
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5C.
W77-06776

LABORATORY STUDIES ON THE EFFECT OF METALS ON OXYGEN UPTAKE BY SEWAGE SLUDGE IN BRACKISH WATER.
Bristol Univ. (England). Dept. of Bacteriology.
For primary bibliographic entry see Field 5C.
W77-06788

A COMPREHENSIVE PLAN FOR THE GLOBAL INVESTIGATION OF POLLUTION IN THE MARINE ENVIRONMENT AND BASELINE STUDY GUIDELINES.
United Nations Educational Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 5A.
W77-06850

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

STUDY OF LEACHATE AT LANDFILL SITES 1975, VOLUME 1.

Holzmaier, McLendon and Murrell, Melville, N.Y.

Department of Environmental Control Publication, Suffolk County, New York, 1975. 131 p, 44 fig, 7 tab, append.

Descriptors: *Landfills, *Water pollution sources, *Monitoring, *Control systems, Data collections, Water wells, Groundwater, *New York, Solid wastes, Leachate, Leaching, *Path of pollutants, Pollution abatement.

Identifiers: *Leachate migration, Migration patterns, Suffolk, County, Long Island(NY).

Increasing population growth and eastward expansion in Suffolk County, coupled with recent evidence suggesting that leachate from landfill sites may endanger the quality of the ground water supply, have hastened the need for solid waste management studies on Long Island, New York. The hydrogeology of each landfill site was defined by the examination of local water well logs and Suffolk County hydrologic studies. Core borings provided data regarding the nature of the underlying material. Characteristics of leachate production and migration are fairly uniform for any given climate zone and composition of refuse. However leachate migrating from landfill often responds to hydrogeologic and fluid dynamic mechanisms not entirely understood. Because the migration path of the leachate plume is uncertain it is important that leachate from landfill be carefully monitored. Monitoring systems should be designed at each site so that vertical as well as aerial distribution of the leachate concentrations can be determined. This can be achieved by placement of observation wells screened at different depths. An additional monitoring safeguard of plotting and periodic testing of local, adjacent private water wells, was used to supplement the above monitoring system. By these methods the spread of leachate can be studied and a control program initiated. (Heiss-NWWA)

W77-06851

USGS SCIENTISTS BRING CALIFORNIA WATER SUPPLY INTO COMPLIANCE WITH FEDERAL REGULATIONS.

Geological Survey, Laguna Niguel, Calif.

For primary bibliographic entry see Field 5G. W77-06853

WASTE INJECTION INTO STRATIFIED GROUND WATER BODIES.

Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.

F. L. Peterson, S. W. Wheatcraft, and D. L. Heutmaker.

Water and Sewage Works, Vol. 124, No. 1, p 60-65, January, 1977. 9 fig.

Descriptors: *Injection wells, *Waste water disposal, *Density stratification, *Saline water-freshwater interfaces, Mixing, Hydrologic models, Saline water intrusion, Groundwater, Water wells.

Identifiers: Ambient flow fields.

To study the mechanics of waste injection into a density-stratified ground water system, experiments were conducted utilizing a sand-packed hydraulic model; the system consisted of a freshwater lens overlying a saltwater body, with a zone of mixing separating the fresh and salt water. Rate of injection, injection depth in relation to the salt-fresh interface, length of injection well section, density of injected and ambient fluids, and ambient flow field strength were evaluated as to their effect on the mechanics of the injection process and ultimate fate of the injected waste effluents. Though several of these parameters, notably depth of injection, affected details of injection plume movement and shape, none of the parameters exerted any significant control on the ultimate fate of

the plume; injection plumes always migrated well into the freshwater lens regardless of variations in parameters. There was little evidence of salt water entrainment in the plumes, suggesting the principal means of effluent plume movement to be mass displacement rather than mixing processes. (Eberle-NWWA)

W77-06855

INVESTIGATION OF FLUSHING TIME IN THE LAFAYETTE RIVER, NORFOLK, VIRGINIA.

Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2L. W77-06881

MICROBIAL METHANE CONSUMPTION REACTIONS AND THEIR EFFECT ON METHANE DISTRIBUTIONS IN FRESHWATER AND MARINE ENVIRONMENTS.

Alaska Univ., College. Inst. of Marine Science.

For primary bibliographic entry see Field 5C. W77-06899

INTERSTITIAL WATER CHEMISTRY OF ANOXIC LONG ISLAND SOUND SEDIMENTS. 1. DISSOLVED GASES.

Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.

C. S. Martens, and R. A. Berner.

Limnology and Oceanography, Vol 22, No 1, p 10-25, January 1977. 8 fig, 4 tab, 46 ref. NSF 7002-AC2, GA 30288X; DES 75-06199.

Descriptors: *Water chemistry, *Bottom sediments, *Water analysis, *Methane, *Water quality, Analytical techniques, Chemistry, Sediments, Chemical analysis, Connate water, Gas chromatography, Gases, Nitrogen, Argon, Water properties, Sulfate, Salinity, Temperature.

Identifiers: *Dissolved gases, *Long Island Sound, *Methane content, Anoxic sediments, Methanogenic bacteria, Methane distributions, Microbial ecology.

Measurements of dissolved N₂, Ar, CH₄, and SO₄(-) and salinity and temperature were used to examine the processes controlling their distributions in the interstitial waters of nearshore sediments. Where sulfate reduction is incomplete, dissolved N₂ and Ar concentrations in the upper 10-30 cm appear to be controlled by macroinfaunal irrigation activities and to vary in accordance with overlying water conditions. Below 30 cm, N₂ and Ar concentrations appear to have been last affected by August through October irrigation. In harbor sediments where sulfate reduction is complete at shallow depths, low N₂ and Ar concentrations result from in situ stripping by methane bubbles. Methane concentrations remain below about 0.1 mM until about 90% of seawater sulfate is removed. As sulfate concentrations approach zero, methane builds up to bubble saturation. Concave-up methane depth distributions can be explained by methane consumption following first-order kinetics in the zone of sulfate reduction. Laboratory jar experiments with natural sediments indicated no methane production during sulfate reduction, which is in agreement with previous models and distribution studies of sulfate reducing and methanogenic bacteria in lake sediments. Combined laboratory and field results support the hypothesis that methane is produced mainly after sulfate is depleted but is consumed within the sulfate reduction zone as it diffuses upward. (Henley-ISWS)

W77-06900

IRON-RICH RHYTHMICALLY LAMINATED SEDIMENTS IN LAKE OF THE CLOUDS, NORTHEASTERN MINNESOTA.

Minnesota Univ., Minneapolis. Limnological Research Center.

For primary bibliographic entry see Field 2J. W77-06901

PARTICULATE TRANSPORT OF RADIONUCLIDES 14C AND 55Fe TO DEEP WATERS IN THE PACIFIC OCEAN.

Scripps Institution of Oceanography, La Jolla, Calif.

D. Lal, and B. L. K. Somayajulu. Limnology and Oceanography, Vol 22, No 1, p 55-59, January 1977. 1 fig, 2 tab, 22 ref.

Descriptors: *Radioisotopes, *Sediments, *Pacific Ocean, Organic matter, On-site data collections, Oceans, Laboratory tests, Carbon radioisotopes, Iron, Carbon, Sediment transport, Sea water, Particle size, Oceanography, *Path of pollutants.

Identifiers: Calcareous particles, Sinking rates.

Observations during 1969-1971 indicated that radionuclides 14C and 55Fe in particulates in Pacific Ocean waters 28-31 deg N, 119-121 deg W up to depths of 2,500 m were transported from the surface within a short time (less than 10 yr). The mean downward sinking rates for 55Fe and 14C were deduced to be 0.0005 and 0.0025 cm/s. The appreciably faster transport of 14C is consistent with the fact that the mean size calculated for biogenic calcareous particles transporting 14C is larger than that for the 55Fe-labeled particles. (Sims-ISWS)

W77-06902

PHOSPHATE PREDICTION MODEL FOR STREAMS BY MEANS OF DISCRIMINANT ANALYSIS.

Cologne Univ. (West Germany). Geographisches Institut.

R. Herrmann, and W. Symader.

Hydrological Sciences Bulletin, Vol 21, No 3, p 397-406, September 1976. 2 fig, 6 tab, 14 ref.

Descriptors: *Phosphates, *Water pollution sources, *Forecasting, *Model studies, Streams, Foreign countries, Mathematical models, Analytical techniques, On-site data collections, Correlation analysis, Land use, Foreign research, Watersheds(Basins), *Path of pollutants.

Identifiers: *Discriminant analysis, *Germany, *Eifel Mountains(Germany).

An attempt was made to predict phosphate load by means of discriminant analysis. Eight groups of data were defined by a cluster analysis. Principal component analysis and an F-ratio of the predictor variables were used to find a most favorable group of predictor variables by which an optimal separation between the eight different groups of data is possible. The discriminant functions, linear combination of the predictors, together with additional help of a classification procedure like Euclidean distances, may be used to assign an individual phosphate measurement to the group it best corresponds to. The discriminant analyses showed that a linear combination of 2 out of a total of 33 predictors, namely the combination of (1) runoff and (2) settlement area, has the best discriminant power. Multivariate tests of significance were performed. Tables were constructed that demonstrate the predicted versus actual group membership. Phosphate load and the predictor variables were measured from 1973 to 1974 in 21 streams draining basins with a variety of groundcovers (farm land, woods, and urbanized areas) in the Eifel Mountains and the bordering loess plains in Germany. (Sims-ISWS)

W77-06906

EFFECT OF THE NILE FLOOD ON THE ESTUARINE AND COASTAL CIRCULATION PATTERN ALONG THE MEDITERRANEAN EGYPTIAN COAST.

Alexandria Univ. (Egypt). Dept. of Oceanography.

For primary bibliographic entry see Field 2L. W77-06907

LOSS OF 2,4-D IN RUNOFF FROM PLOTS RECEIVING SIMULATED RAINFALL AND

FROM A SMALL AGRICULTURAL WATERSHED,

Southern Piedmont Conservation Research Center, Watkinsville, Ga.

A. W. White, Jr., L. E. Asmussen, E. W. Hauser, and J. W. Turnbull.

Journal of Environmental Quality, Vol 5, No 4, p 487-490, 1976. 2 fig, 2 tab, 24 ref.

Descriptors: *Water pollution, *Pollutants, *Herbicides, *2,4-D, *Georgia, *Agricultural chemicals, Water quality, Water analysis, Water chemistry, Water pollution sources, Agricultural runoff, Small watersheds, Storm runoff, Subsurface runoff, Leaching, Rainfall, Soils, Agricultural watersheds, Chemical wastes, Pesticide residues. Identifiers: Dissipation, Analytical procedures.

Movement of 2,4-D (2,4-dichlorophenoxy) acetic acid) was not significant in either surface or subsurface runoff from a small agricultural watershed on a sandy herbicide application (0.56 kg/ha) each year, and initial concentrations were related to the time lapse between herbicide application and the date of the first runoff event. Maximum concentrations were 8.1, 6.2, and 2.5 micrograms/liter, in 1970, 1971, and 1972, respectively. The corresponding time lapse for the same years was 20, 27, and 34 days. Persistence studies showed that the 2,4-D concentration in the surface 0.5 cm of soil decreased 95%, from 4.7 to 0.23 ppm in only 7 days, and after 34 days, the soil concentration was only 0.01 ppm. Although subsurface flow was three times greater than surface runoff during the 3-year period, 2,4-D movement in subsurface water was negligible. Concentrations were usually zero or less than 1 microgram/liter. Soil sampled to a 90-cm depth showed no 2,4-D accumulation or buildup in the soil profile. Simulated rains (8.25 cm in 30 min) applied to subplots on the watershed showed that there is a potential for greater 2,4-D losses in surface runoff when it rains soon after herbicide application. When rains were applied 1, 8, and 35 days after herbicide application, the average 2,4-D concentrations in runoff were 25.2, 5.8, and 0.7 micrograms/liter, respectively. (Henley-ISWS) W77-06908

THE IMPACT OF FERTILIZER USE AND CROP MANAGEMENT ON NITROGEN CONTENT OF SUBSURFACE WATER DRAINING FROM UPLAND AGRICULTURAL WATERSHEDS,

Agricultural Research Service, Coshocton, Ohio. North Appalachian Experimental Watershed. F. W. Chichester.

Journal of Environmental Quality, Vol 5, No 4, p 413-416, October-December 1976. 2 fig, 3 tab, 13 ref.

Descriptors: *Nitrogen compounds, *Fertilizers, *Water pollution sources, *Agricultural chemicals, *Agricultural watersheds, *Ohio, Nitrates, Leaching, Water quality, Nitrogen, Ammonia, Nutrient removal, Nutrients, Water pollution, Land management, Hydrogeology, Groundwater, Soils, Watershed management, Fertilization. Identifiers: *Nitrogen content, *Crop management practices, *Nitrate leaching, Soil drainage, Nitrogen forms, Nitrogen transport, Agricultural practices.

Spring flow and stream base flow sites were sampled weekly on, and adjacent to, a 123-ha agricultural watershed in the Allegheny-Cumberland Plateau physiographic region of east-central Ohio. Nitrogen content of samples was used to determine the influence of various N fertilizer and crop management practices on the quality of subsurface water draining from defined contributing areas. Measured nitrogen contents of spring flow were related to fertilizer N regime of the different agricultural practices investigated. Changes in land management on the area contributing to spring flow were reflected in changes in nitrogen content of water from that spring. The amount of nitrogen

which was transported into the stream channel was directly related to seasonal variation in subsurface flow rate in two ways. First, the concentration of N in spring flow increased with an increase in the amount of water percolating through the overlying soil and shale. Second, the extent to which downstream quality was affected, i.e., the distance from the area of fertilizer application at which an increase in nitrogen content could be detected, also increased with the volume of flow from the springs. (Henley-ISWS) W77-06909

NUTRIENTS, CHLOROPHYLL, AND INTERNAL TIDES IN THE ST. LAWRENCE ESTUARY,

Laval Univ., Quebec, Department de Biologie. J.-C. Theriault, and G. Lacroix.

Journal of the Fisheries Research Board of Canada, Vol. 33, No. 12, p 2747-2757, December 1976. 11 fig, 1 tab, 16 ref.

Descriptors: *St. Lawrence River, *Estuaries, *Tidal waters, Nutrients, *Chlorophyll, Tides, Currents(Water), *Water temperature, *Salinity, *Nitrates, *Dissolved oxygen, *Phosphates, On-site investigations, Data processing, Mixing, Circulation, Water circulation, *Path of pollutants, Water pollution. Identifiers: *Laurentian Channel, *Internal tides, Internal oscillations.

Tide-dependent variations of temperature, salinity, dissolved oxygen, phosphate, nitrate, and chlorophyll support the existence of internal tides (longitudinal and transversal) in the St. Lawrence estuary. Vertical oscillations of the poorly oxygenated and nutrient-rich intermediate and deep waters of the estuary have been documented at the head of the Laurentian Channel, the region in which the internal tides are thought to be generated. Penetration of intermediate waters (high-nutrient and low-oxygen concentrations) beyond the Laurentian Channel associated with the internal tides and linked with an intense mixing process in the upstream region permits the nutrient enrichment of the surface waters and their eventual advection in the seaward direction. (Sims-ISWS) W77-06910

HIGH SEAS OIL POLLUTION: PARTICULATE PETROLEUM RESIDUES IN THE NORTH ATLANTIC,

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab. E. M. Levy, and A. Walton.

Journal of the Fisheries Research Board of Canada, Vol. 33, No. 12, p 2781-2791, December 1976. 9 fig, 5 tab, 15 ref.

Descriptors: *Oil pollution, *Atlantic Ocean, *Sampling, Surveys, Data processing, Water pollution sources, Oceans, Oil spills, Circulation, Ocean circulation, Ocean currents, Pollutants, Path of pollutants, Water pollution. Identifiers: *Particulate petroleum residues, *North Atlantic, Tar.

The results of a continuing investigation into the occurrence and distribution of particulate petroleum residues on the surface of the North Atlantic were presented. From 1971 to 1974 more than 850 samples were collected from the North Atlantic on transects between the east coast of Canada and South America, the Caribbean, Baffin Bay and surrounding waters, the Labrador Sea, and the Azores. Repeated sampling was carried out in the Gulf of St. Lawrence and the region between Nova Scotia and Bermuda. The results indicated that the waters north of the Gulf Stream-North Atlantic Current system were virtually free from floating petroleum residues, while the waters of the Gulf Stream, Sargasso Sea, and Caribbean Sea were much more heavily polluted. Although concentrations as high as 91.8 mg/sq m were encountered,

the general level of pollution was much less with tar contents in southern waters following a lognormal distribution with a geometric mean of 0.16 mg/sq m. The geographical distribution of tar is interpreted in terms of inputs from shipping and tanker traffic, and surface circulation patterns. (Sims-ISWS) W77-06911

DISPERSION OF LIQUID WASTE FROM A MOVING BARGE,

Alabama Univ., Tuscaloosa.

J. Ball, and T. D. Reynolds.

Journal of Water Pollution Control Federation, Vol. 48, No. 11, p 2541-2548, November 1976. 8 fig, 3 tab, 7 ref.

Descriptors: *Waste disposal, *Barges, *Industrial wastes, *Oceans, Wastes, Disposal, *Waste dilution, Water pollution, *Dispersion, Ecological distribution, Sea water, Waste treatment, Water quality, Water pollution sources, Waste water disposal, Water analysis, Environmental sanitation, *Path of pollutants. Identifiers: *Ocean dumping, Waste discharge, Discharge techniques, Dispersion phenomenon, Barge velocity.

Recent Environmental Protection Agency ocean dumping regulations required field investigations of the dispersion of liquid wastes behind moving barges. Data from two such studies, combined with ocean dumping data from previous work, available in the literature, permitted a re-evaluation of the dispersion phenomenon. Field data and the procedures used to collect it were presented. Data indicated that in all cases, the waste concentrations in the water followed a straight line on a log-log graph rather than first-order decay according to eddy diffusion theory. A general relationship was presented to describe the field data and included the effect of barge velocity and discharge rate. (Henley-ISWS) W77-06913

FATE OF NITROGEN AND PHOSPHORUS IN SOILS UNDER SEPTIC TANK WASTE DISPOSAL FIELDS,

Agricultural Research Service, Beltsville, Md. Biological Waste Management Lab.; Agricultural Research Service, Beltsville, Md. Soil Nitrogen Lab.; and Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.

L. J. Sikora, and R. B. Corey.

Transactions of the American Society of Agricultural Engineers, Vol. 19, No. 5, p 866-870, 875, September-October 1976. 4 fig, 35 ref.

Descriptors: *Nitrogen compounds, *Phosphorus compounds, *Septic tanks, *Water pollution sources, *Soil disposal fields, Nitrates, Leaching, Water quality, Nitrogen, Ammonia, Nutrient removal, Phosphates, Phosphorus, Disposal, Domestic wastes, Nutrients, Waste treatment, Hydrogen ion concentration. Identifiers: *Waste disposal fields, Public health problems.

Probable nitrogen forms in soils under septic tank waste disposal fields were predicted by correlating observed soil moisture tensions with aeration status. The conditions beneath most waste disposal fields are sufficiently aerobic for nitrate to be the probable nitrogen form. The probable phosphorus form would depend upon many factors, including mineral content and pH of the soil. Due to high P concentration in septic tank wastes, both sorption and decomposition-precipitation reactions must be considered when determining P movement. Only in soils with little sorption capacity would the pollution potential of phosphorus from septic tank waste be considerable. (Henley-ISWS) W77-06914

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

MISSISSIPPI SOUND TEMPORAL AND SPATIAL DISTRIBUTION OF NUTRIENTS, Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss. Gulf Coast Research Lab. C. K. Eleuterius.

Report No MASGP-76-024, (1976). 63 p, 54 fig, 4 tab, 8 ref, append. SG-04-5-158-54.

Descriptors: *Estuaries, *Nutrients, *Baseline studies, *Resources development, *Environmental effects, *Water quality, Water resources, Mississippi, Effluents, Nitrates, Phosphates, Dredging, Construction, *Temporal distribution, *Spatial distribution, *Path of pollutants.

Identifiers: *Mississippi Sound.

Mississippi Sound, as estuarine system, is the eventual recipient of the accumulative effluents from activities throughout the drainage basin and is further altered by other direct actions such as dredging and construction. In order to assess the effect of present and future development on the water quality of the Sound, it is necessary to ascertain the existing regime of nutrients through determination of descriptive norms and causal relationships. A 'baseline' thus established serves as a reference to which perturbations in the nutrient levels can be compared to evaluate whether the level is a normal variation or an abnormality. The estuarine waters are the principal sources of the major elementary components of estuarine organisms: carbonate, phosphate and nitrate ions. While added amounts of phosphates and nitrates serve to increase the fertility of the estuary, excessive amounts result in algae blooms and accompanying anoxic conditions. Excessive nutrient levels result in degradation of water quality and are therefore used as indicators of pollution. One objective of the Mississippi Sound research effort was to ascertain the temporal and spatial distribution of nutrients. (NOAA)

W77-06932

LITERATURE REVIEW OF WASTEWATER CHARACTERISTICS AND ABATEMENT TECHNOLOGY IN THE WOOD AND TIMBER PROCESSING INDUSTRY.

For primary bibliographic entry see Field 5D. W77-06951

DETERMINATION OF FREE FORMIC AND ACETIC ACIDS BY GAS CHROMATOGRAPHY USING THE FLAME IONIZATION DETECTOR, Geological Survey, Lakewood, Colo. Water Resources Div.

For primary bibliographic entry see Field 5A. W77-06961

REVIEW AND ANALYSIS OF HYDROGEOLOGIC CONDITIONS NEAR THE SITE OF A POTENTIAL NUCLEAR-WASTE REPOSITORY, EDDY AND LEA COUNTIES, NEW MEXICO,

Geological Survey, Albuquerque, N Mex. Water Resources Div. J. W. Mercer, and B. R. Orr. Open-file report 77-123, February 1977. 35 p, 7 fig, 1 tab, 36 ref.

Descriptors: *Radioactive waste disposal, *Surveys, *Underground waste disposal, *Aquifer characteristics, *Water quality control, *New Mexico, Reviews, Evaluation, Groundwater movement, Hydrogeology, Groundwater recharge, Nuclear wastes, Sites, Planning. Identifiers: Eddy and Lea Counties(N Mex).

This interim report reviews and summarizes the hydrogeology of rocks associated with the Permian salt beds (Castile and Salado Formations) of Los Medanos area in southeastern New Mexico. The information will be considered, together with other factors, in the preparation of an analysis of the impact of a potential nuclear-waste repository

on the environment. Most of the geologic units in and adjacent to the Permian salt deposits are characterized by low permeabilities and highly mineralized water. Sandstone of the Delaware Mountain Group, which underlies the salt, has an average hydraulic conductivity of 0.16 ft/d and an average porosity of 15.65 percent. Flow is north-northeastward toward the margin of the Capitan Limestone, at velocities ranging from 0.0005 to 0.0008 ft/d. The Capitan Limestone, a relatively high yielding limestone-reef aquifer adjacent to the study area, has transmissivity values ranging from 500 sq ft/d to 10,000 sq ft/d and an average hydraulic conductivity of about 5 ft/d. Water movement west of the Pecos River is northeastward in the reef, with discharge at Carlsbad Springs. East of the Pecos River, water moves at very low rates and the direction of movement is uncertain. The Castile and Salado Formations, which might be used to contain the nuclear waste, have a few isolated pockets of brine and gas, but generally transmit little or no ground water. (Woodard-USGS)

W77-06974

GEOLOGY AND GROUND WATER IN DOOR COUNTY, WISCONSIN, WITH EMPHASIS ON CONTAMINATION POTENTIAL IN THE SILURIAN DOLOMITE,

Geological Survey, Madison, Wis. Water Resources Div. M. G. Sherrill.

Open-file report 77-61, February 1977. 92 p, 19 fig, 5 tab, 34 ref.

Descriptors: *Hydrogeology, *Water pollution sources, *Path of pollutants, *Groundwater movement, Groundwater resources, Water quality, Waste disposal, Agricultural chemicals, Industrial wastes, Municipal wastes, *Wisconsin.

Identifiers: Door County(Wis).

Door County, a recreational and fruit-growing area bordering Lake Michigan in northeastern Wisconsin, has had a long history of ground-water contamination from surface and near-surface sources. Contamination is most severe in late summer when fruit-canning operations and the influx of tourists create additional wastes. Silurian dolomite is the upper bedrock unit in the county and yields generally adequate supplies of very hard water with locally objectionable concentrations of iron and nitrate. Thin soil cover and well-fractured dolomitic bedrock give easy entry to ground-water contaminants throughout large parts of Door County. Many contaminants enter the dolomite by surface or near-surface seepage. There is little attenuation of contamination concentrations in the well-jointed dolomite, and contaminants may travel long distances underground in a relatively short time. The major source of ground-water contamination is bacteria, from individual waste-disposal systems, agricultural, industrial, and municipal wastes. Areas of the county underlain by contaminated zones include only a small percentage of the total ground-water system and are separated by large volumes of ground water free of contamination. (Woodard-USGS)

W77-06975

APPLICATION OF DIGITAL MODELLING TO THE PREDICTION OF RADIOISOTOPE MIGRATION IN GROUNDWATER,

Geological Survey, Menlo Park, Calif. Water Resources Div. J. B. Robertson.

Reprint from: Isotope Techniques in Groundwater Hydrology 1974, Vol II, p 451-478, 1974: International Atomic Energy Agency, Vienna, Austria, 1974. 15 fig, 12 ref.

Descriptors: *Model studies, *Tracking techniques, *Path of pollutants, *Radioisotopes, *Groundwater movement, Digital computers, Radioactive wastes, Analytical techniques, Forecasting, Tritium. Identifiers: Sr-90 movement in groundwater.

Recently developed numerical techniques have been adapted to the solution of transient radioactive solute migration problems in groundwater. The differential equations of groundwater movement are first solved by standard finite difference methods, then the differential equations of solute transport are solved by the method of characteristics. Validity of the simulation techniques is demonstrated for real examples of tritium, chloride and Sr-90 migration in groundwater at the National Reactor Testing Station, Idaho. This is probably the first documented field-verification of such a model that includes the effects of convective transport, two-dimensional dispersion, radioactive decay and ion exchange. Model results demonstrate the relative sensitivity of ground-water transport systems to various parameters, such as dispersion coefficients and ion-exchange distribution coefficients. The models can be very useful in predicting the behavior of natural isotopes, artificial tracers or waste in groundwater. The models allow variable hydraulic parameters in space and time, as well as variable chemical parameters. Predictive use of such models is demonstrated for several different conditions in heterogeneous basaltic aquifer. Thirty-year predictions of tritium and Sr-90 migrations are shown with variable hydraulic and chemical influences. Additional methods and potential applications of modelling are suggested, including tracer migration studies and natural isotope distributions in groundwater. (Woodard-USGS)

W77-06981

SEDIMENTS AND WATER QUALITY OF URBAN STORM WATER,

Middlesex Polytechnic, London (England). J. B. Ellis.

Water Services, Vol. 80, No. 970, p 730-734, December, 1976. 4 fig, 10 ref.

Descriptors: *Storm runoff, *Urban runoff, *Water pollution sources, Heavy metals, Sediments, Oxygen demand, Surface runoff, Hydrology, Hydrogen ion concentration, Storm water, Water quality.

Identifiers: Silk Stream(London England).

The Silk Stream catchment, a tributary of the River Brent, in North London, was studied to gather information on the relationship between sediments and water quality of urban storm water. Storm water runoff contains a substantial quantity of pollutants which can present a more serious problem than municipal wastes. Typical components of storm water are organic compounds, fecal bacteria, heavy metals, and suspended solids. Oils, phenols, detergents, and greases are other pollutants. Hydrogeologic and other characteristics of the area were studied. Storm water sediment composition is dominated by inorganic mineral fractions (45-70%) from roof, pavement, and street surfaces; also included are brick, glass, concrete, ash, bitumen, rubber-coated particles, minor amounts of plastics, aggregate, and metallic particles. These sediments are well sorted, spherical, and concentrated in the 0.1-0.5 millimeter range. Accumulated discharge of huge amounts of sediment in the receiving channels produces a very thick gelatinous benthic sludge. When these sludges are oil, grease, and detergent, flocs bubble to the surface. This bubbling and flotation are signs of decomposition, just as depressed pH and dissolved oxygen values indicate. Benthic sludges have a high ionic adsorptive capacity, mainly from inorganic matter in the sediment. Organic components increase the potential by decomposing to release complex, toxic compounds into surrounding sediments or by solution release into the stream. There is a strong likelihood of co-precipitation of trace metals with these substances as well as with free iron oxides, rubber, and bitumen components. The use of sediment loads to upgrade nutrient rich waters, to take chemical species from the solution phase, or to remove these species, heavy metals, and organic compounds from the stream are all feasible water quality goals. (Collins-FIRL)

W77-06984

BIOGENIC ELEMENTS AND SULFATE REDUCTION IN WATER OIL CARBONATE LAYER, (IN RUSSIAN).

Akademiya Nauk SSSR, Moscow. Institut Mikrobiologii.
E. P. Rozanova, V. N. Bykov, A. L. Baldina, and T. A. Kosogorova.
Mikrobiologiya 45(2), p 365-369, 1976.

Descriptors: *Sulfates, Oil, Bacteria, *Biodegradation, *Hydrogen sulfide, Carbonates, Salinity, Sediments.
Identifiers: *Biogenic elements, *USSR(Polaznensky deposit).

Biogenous sulfate reduction (bacterial) and accumulation of secondary H₂S were caused by the action of pumping waters with a low mineral content on carbonate collectors with a high concentration of relict H₂S during long periods of time. The amount of sulfates, phosphates and ammonium N in water from layers of various mineralization is sufficient for active sulfate reduction. Sulfates and phosphates are eliminated from rocks of layers with diluted waters. The maximum increase of SO₄²⁻ in waters was 1545 mg/l, that of HPO₄²⁻ was 0.34 mg/l. The amount of ammonium decreases with mineralization of the layer waters, remaining within the range of 129-7 mg/l. The content of CO₂ and HCO₃⁻ increases in diluted waters to 197 and 695 mg/l, respectively, correlating with biogenous processes. The highest number of sulfate reducing bacteria (dozens of thousands of the cells per ml) was found in H₂O with mineralization of 19 g/l. Curves for the content of SO₄²⁻, HPO₄²⁻, NH₄⁺ and CO₂ have a common maximum in waters of the Polaznensky deposit (USSR) with a salinity of 62 g/l.—Copyright 1977, Biological Abstracts, Inc.
W77-07040

DRUGS AND DRUG METABOLITES AS ENVIRONMENTAL CONTAMINANTS: CHLOROPHENOLISOBUTYRATE AND SALICYLIC ACID IN SEWAGE WATER EFFLUENT,

Veterans Administration Hospital, Kansas City, Mo.
For primary bibliographic entry see Field 5A.
W77-07045

ACCUMULATION OF HEAVY METALS IN SOILS FROM EXTENDED WASTE WATER IRRIGATION,

Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. C. Sidle, J. E. Hook, and L. T. Kardos.

Descriptors: *Heavy metals, *Irrigation, *Soil contamination, Sewage effluents, Sewage disposal, Soil types, Waste water treatment, Copper, Zinc, Cadmium, Lead, Nickel, Cobalt, Metals, Vegetation, Food chains.

Accumulation and distribution of heavy metals due to waste water infiltration were investigated in soil profiles of a reed canarygrass and a corn rotation area. The soils were irrigated year-round with chlorinated secondary treated waste water effluent. Copper, zinc, cadmium, lead, nickel, and cobalt were studied. Effluent concentrations of these metals were in the lower range for heavy metals in waste water effluents given in previous studies. Extractable soil copper and zinc accumulated substantially at a depth of 0 to 30 centimeters in the reed canarygrass area, but cadmium levels in the surface foot of soil increased to a lesser degree. Copper was the only metal with a significant accumulation rate over time in the same depth range of the corn areas, and less than the copper concentration in the d canarygrass areas. No definite indications were found that the heavy metals moved from this depth range in either area

and there were no definite accumulation trends with time for lead, nickel, or cobalt in either area. No serious soil contamination by these metals was indicated in either study area. Cadmium:zinc ratios approached that of the waste water applied in both cases, which was 0.68 to 1%. Further monitoring of heavy metal levels in the surface foot of soil and in vegetation would avoid possible food chain contamination. (Collins-FIRL)
W77-07049

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: II. FRACTIONATION OF ACCUMULATED PHOSPHATES,

Agricultural Univ., Wageningen (Netherlands).
J. Beck, F. A. M. de Haan, and W. H. van Riemsdijk.
Journal of Environmental Quality, Vol 6, No 1, p 7-12, January-March, 1977. 2 fig, 4 tab, 24 ref.

Descriptors: *Phosphates, *Sewage disposal, Soil contamination, Sewage effluents, Organic matter, Inorganic compounds, Aluminum, Hydrogen ion concentration, Waste water treatment, Storage.
Identifiers: Sewage farms.

Investigations, using phosphate fractionation methods, were conducted on sewage farm soils to determine whether the chemical forms of phosphate accumulation in soil change with prolonged sewage water addition. Phosphate accumulation in soils flooded with sewage water for 30 and 50 years is mostly restricted to the upper 50 centimeters of soil. Phosphorus fractionation methods revealed that 15-20% accumulated in organic form. Most of the inorganic fraction was found in combination with aluminum or iron, and solubility relationship determinations indicated a possible precipitation of apatite-like compounds in soils with a nearly neutral pH. Aluminum combined phosphates were found to be prevalent. It was thought that phosphate retention is mostly governed by reactions with aluminum since the phosphate fractions distribution pattern remained practically the same during the lifetime of the sewage farm. Ultimate storage capacity of the soil for phosphate bonding is mainly determined by the presence of active aluminum compounds. (See also W77-07052 and W77-07054) (Collins-FIRL)
W77-07053

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: III. KINETIC STUDIES ON THE REACTION OF PHOSPHATES WITH ALUMINUM COMPOUNDS,

Agricultural Univ., Wageningen (Netherlands).
W. H. van Riemsdijk, F. A. Westra, and J. Beck.
Journal of Environmental Quality, Vol 6, No 1, p 26-29, January-March, 1977. 3 fig, 4 tab, 8 ref.

Descriptors: *Adsorption, *Phosphate, *Kinetics, Chemical reactions, Sewage effluents, Sewage disposal, Waste water disposal, Soil contamination, Chemical properties, Disposal.
Identifiers: Aluminum hydroxide.

The reaction of phosphate and aluminum hydroxide and alpha Al₂O₃ was studied in order to understand the kinetics of phosphate precipitation reactions in land disposal of raw sewage water. An initial phosphate concentration of 0.35 millimoles/liter at 20°C was used. Sources of the phosphate were solutions of KH₂PO₄ and synthetic inorganic sewage water. Highest values of removed phosphate occurred when KH₂PO₄ solutions were used; this was attributed to the lack of competitive anions for adsorption. The ionic strength of this solution was lower and phosphate activities were much higher than in synthetic waste water. The mechanism of the reaction kinetics was similar with both adsorbent types used and was, possibly, influenced by the surface structure of the adsorbent. Characteristics of phosphate removal reactions were a first, fast adsorption on the surface of the adsorbent, and the formation of a solid aluminum phosphate phase.

After 40 days, the reaction rate does not fit the presented first order equation. (See also W77-07052 and W77-07053) (Collins-FIRL)
W77-07054

SOLUBILITY AND PLANT UPTAKE OF CADMIUM IN SOILS AMENDED WITH CADMIUM AND SEWAGE SLUDGE,

Colorado State Univ., Fort Collins. Dept. of Agronomy.
J. J. Street, W. L. Lindsay, and B. R. Sabej.
Journal of Environmental Quality, Vol 6, No 1, p 72-77, January-March, 1977. 8 fig, 4 tab, 34 ref.

Descriptors: *Cadmium, *Adsorption, *Solubility, *Soils, Physical properties, Chemical properties, Sludge, Alkalinity, Corn, Organic matter, Toxicity, Absorption.
Identifiers: Precipitation, Freundlich equation.

Adsorption and precipitation are investigated as controlling factors in cadmium concentration in soils. Factors studied, in addition to adsorption and precipitation, were plant uptake and chemical extraction of cadmium. The addition of soluble cadmium to soil produced a rapid removal of cadmium from solution by adsorption on to soil constituents and by the possible formation of solid phases of cadmium compounds. Solutions containing less than 50 micrograms of Cd(2+)/milliliter produced data which fit the empirical Freundlich equation in all soils. In alkaline sandy soils, high concentration cadmium precipitated, perhaps, as CdCO₃ and Cd₃(PO₄)₂. When added to soil, either alone or with sludge, cadmium was taken up by corn seedlings. Cadmium alone was more readily taken up by soil than the combination of cadmium and sludge. Organic matter in one test soil depressed cadmium uptake, possibly indicating a reduced availability of cadmium sorbed to organic matter. High levels of cadmium can be accumulated by corn seedlings without visual toxicity symptoms. The DTPA soil test method was useful in estimating the cadmium uptake by corn seedlings grown on cadmium-contaminated soils. (Collins-FIRL)
W77-07055

UNDERFLOW FROM SLUDGE-IRRIGATED CROPLAND,

Springfield Sanitary District, Ill.
R. C. Andrew, and A. P. Troemper.
Journal Water Pollution Control Federation, Vol 49, No 1, p 161-168, January, 1977. 1 fig, 10 tab.

Descriptors: *Irrigation, *Underflow, *Liquid wastes, Sludge digestion, Sludge disposal, Aerobic treatment, Drainage, Suspended solids, Biochemical oxygen demand, Leachates, Soil disposal fields, Soil contamination, Metals, Inorganic compounds, Organic matter, Nitrogen, Oxidation, Economics, *Illinois.
Identifiers: Springfield Sanitary District(ILL).

The Springfield Sanitary District, Illinois, has instituted the use of cropland spray irrigation for liquid disposal of aerobically digested sludge. Two sites totaling 66 acres are used. They have permanent underdrainage systems which collect and pump the underflow back to the aeration tanks at the treatment plant. Data indicated underdrain water volumes were more parallel to rainfall than to applied sludge volumes. Soil filtration produced a 99.96% average BOD₅ reduction and an 99.98% average suspended solids reduction. Average component levels were 0.9 milligrams/liter of BOD₅, 5.6 milligrams/liter of suspended solids, and 1,179/100 milliliters of fecal coliform. The median pH was 7.1 for applied sludge and 7.0 for underdrain water; soil pH was basically unaffected. Small amounts of phosphates leached to underdrain water and phosphate removal averaged 98.5%. Enough iron, aluminum, and calcium were present to react with phosphates and make insoluble products which were held in the upper soil layers. Nitrogen was almost completely oxidized

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

to nitrate nitrogen. Under normal conditions, the cations calcium, magnesium, potassium, and sodium will not be likely to leach to underdrain water. Chromium, lead, cadmium, and nickel did not appreciably collect in the soil. This method was the most economical of all tested and irrigation proved a viable disposal means for waste water sludge. It is simple, needs a minimum of operation attention, and does not create an odor nuisance if sludge is well digested before application. (Collins-FIRL) W77-07056

SHORT COURSE PROCEEDINGS: APPLICATIONS OF STORMWATER MANAGEMENT MODELS.

Massachusetts Univ., Amherst. Dept. of Civil Engineering. Available from the National Technical Information Service, Springfield, VA 22161 as PB-247 163. Price codes: A19 in paper copy, A01 in microfiche. Report EPA-670/2-75-065, June, 1975. 426 p. 137 fig. 56 tab.

Descriptors: *Model studies, *Water management (Applied), *Storm water, *Storm runoff, *Combined sewers, Hydrologic data, Water pollution, Pollution abatement, Simulation analysis, Mathematical models, *Computer programs. Identifiers: *EPA Stormwater Management Model (SWMM).

Presentations are made of various storm water models to solve the problem of storm and combined sewer overflows and to make state pollution control agencies aware of these resources for pollution abatement. Discussed in the proceedings are such problems as the environmental effects of urban storm water runoff, the quantity and quality aspects of this runoff, the effects of runoff on the quality of receiving waters, and decision-making regarding quantity and quality control of water. The papers presented included data requirements and case studies of the different models, along with comparative analyses. Amongst the various models, the EPA Stormwater Management Model (SWMM) was highlighted. (See W77-07067 thru W77-07073) (Kutcher-FIRL) W77-07066

INTRODUCTION TO URBAN STORM WATER RUNOFF MODELS.

Water Resources Engineers, Springfield, Va. R. F. Shubinski.

In: Short Course Proceedings: Applications of Storm Water Management Models, August 19-23, 1974, Amherst, Massachusetts, University of Massachusetts, Amherst, p 177-199. 15 fig. 4 tab. 6 ref.

Descriptors: *Model studies, *Storm runoff, Water quality, Sewerage, Watersheds, Hydrologic aspects, *Urban runoff, Infiltration, Sewage effluents, Drainage, Flow.

Storm water runoff models were applied to a simplified urban drainage system. This system was composed of subsystems dealing with surface runoff, transport and quality of flow, and receiving waters. The surface runoff subsystem was a drainage area tributary to a sewer inlet—a system of surface elements, gutters, and drainage ditches. The transport system is the physical works which carry storm waters and their pollutant load from inlets through underground conduits to a point of disposal. Receiving systems could be streams, lakes, estuaries, or coasts. The hydrologic effects of urbanization and the characteristics of the urban watershed were considered. Factors controlling urban runoff include rainfall, infiltration, depression storage, surface detention and gutter detention, and storage in house drains, catch basins and major sewage elements. Land use influences imperviousness and surface cover which regulate surface depression, detention, and infiltration. A storm drainage model should analyze storm discharge from urban runoff by dividing the

total basin into smaller homogeneous units to calculate individual runoff contributions. Collection of individual sub-basin outflows and their routing through main storm sewers allow determination of total watershed outflow at the basin outlet. (See also W77-07066) (Collins-FIRL) W77-07071

SIMPLIFIED METHODS OF COMPUTING THE QUANTITY OF URBAN RUNOFF.

Water Resources Engineers, Springfield, Va. R. P. Shubinski.

In: Short Course Proceedings: Applications of Storm Water Management Models, August 19-23, 1974, Amherst, Massachusetts, University of Massachusetts, Amherst, p 200-213. 7 fig. 4 tab. 2 ref.

Descriptors: *Analytical techniques, *Storm runoff, *Urban runoff, *Unit hydrographs, Peak discharge, Precipitation, Rainfall-runoff relationships, Watersheds (Basins), Design data, Drainage engineering, *Methodology.

Methods are considered for the computation of urban runoff quantities. Flow-frequency analysis involves using equations to obtain natural watershed conditions; plotting the computed discharges on probability paper and fitting a smooth curve; adjusting natural discharge for urbanization effects; and determining the required discharge. The rational method computes overland and channel travel time to obtain concentration time for watershed and design rainfall duration; it also computes the basin-wide coefficient of runoff precipitation intensity; and it determines peak discharge. The unit hydrograph method requires determining the rainfall excess available to the direct runoff process; separating baseflow from the corresponding hydrograph; determining volume of direct runoff; and dividing ordinates of the hydrograph (without baseflow) by volume of direct runoff. (See also W77-07066) (Collins-FIRL) W77-07072

THE WRE STORM MODEL.

Water Resources Engineers, Springfield, Va. R. P. Shubinski.

In: Short Course Proceedings: Applications of Storm Water Management Models, August 19-23, 1974, Amherst, Massachusetts, University of Massachusetts, Amherst, p 214-242. 8 fig. 5 tab. 9 ref.

Descriptors: *Model studies, *Water pollution sources, *Storm runoff, *Urban runoff, Precipitation (Atmospheric), Land use, Erosion, Urban hydrology, Analysis, Water quality, Watershed management.

The WRE STORM model was developed to help determine future magnitudes of urban runoff pollution loads from a given watershed, to help determine the pollution load for average and extreme events, and to determine the occurrence of a given extreme event. The STORM (storage, treatment, overflow, and runoff model) considers interconnections of precipitation, air temperature for snowpack accumulation and snowmelt, runoff, pollutant accumulation on land surface, land surface erosion, treatment rates, storage, and overflows from the storage/treatment system. Land uses considered in this model include: single family residential, multiple family residential, commercial, industrial, parks, and non-urban or undeveloped areas. It is used with many years of continuous hourly precipitation records and may be used for selected single events as well as for continuous simulation. (See also W77-07066) (Collins-FIRL) W77-07073

WATER QUALITY SIMULATION OF TAHOE-TRUCKEE SYSTEM, NEVADA-CALIFORNIA. VOLUME I.

Nevada Univ., Reno. Desert Research Inst. J. A. Westphal, J. V. A. Sharp, and R. L. Bateman.

Available from the National Technical Information Service as PB-247 798. Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-76-005a, 1976. 67 p. 19 fig. 15 tab. 54 ref.

Descriptors: *Model studies, *Inorganic compounds, Water quality, *Water quality control, *Rivers, *Streams, Flows, Industrial wastes, Municipal wastes, Agricultural runoff, Surface waters, California, Nevada, Lakes. Identifiers: *Tahoe-Truckee water system (Nev and Calif).

A model was developed to aid inorganic water quality control in the Tahoe-Truckee water system of Nevada and California. In this system impoundments, diversions for and returns from industrial, agricultural, and municipal uses, and groundwater returns influence inorganic quality and surface water flows. Mass-flux-balance is the basis of the model. Assumptions used relative to the model include: a conservative nature for inorganic constituents, instantaneous, complete mixing, and the accurate recaptulation of flows at an unused gaging station. The model is based on data collected over three years at 40 sites. Calcium, sodium, potassium, chloride, sulfate bicarbonate, silica, magnesium, and total dissolved solids (less silica) were modeled. The model simulates concentrations at selected points and quality of dispersed flows. (Collins-FIRL) W77-07075

WATER QUALITY INVESTIGATIONS IN THE SOUTH PLATTE RIVER BASIN, COLORADO, 1971-72.

National Field Investigations Center, Denver, Colo.

For primary bibliographic entry see Field 5A. W77-07076

A NONLINEAR MULTILEVEL TRANSPORTATION MODEL FOR WATER RESOURCE-WATER QUALITY MANAGEMENT, Utah State Univ., Logan.

S. Pratishtananda. Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 76-25,626. PhD Thesis, 1976, 181 p.

Descriptors: *Model studies, *Water resources, Comprehensive planning, Water reuse, Water quality, Effluents, Water users, Costs, Groundwater, Water resources.

A nonlinear multilevel transportation model was developed for the study of large scale water resources systems. This included allocation to multiple users and effluent treatment to meet required water quality standards. The basic framework is a modified transportation matrix. Included are cost functions for treatment and water transport. Salt Lake County, Utah, was used as a case study area. It was divided into four subregions with the water supplies as the interconnecting variables. Surface water, groundwater and import water were allocated to municipal, industrial and agricultural users for projected 1985 median needs. Effluent from treatment facilities were required to meet goals of Public Law 92-500. Management alternatives considered were allocations with no reuse of treated effluent and allocations with effluent reuse allowed for industrial and agricultural users. The reuse of effluent proved to be least costly. The model was considered as efficient or better than nonlinear formulations. (Collins-FIRL) W77-07096

5C. Effects Of Pollution

THE ACCUMULATION OF ORGANIC MERCURY FROM SEA WATER BY THE PLAICE, *PLEURONECTES PLATESSA* L.,

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

R. J. Pentreath.

Journal of Experimental Marine Biology and Ecology, Vol. 24, p. 121-132, 1976. 7 fig, 5 tab, 12 ref.

Descriptors: *Metals, *Mercury, *Tracers, *Fish physiology, Metabolism, Path of pollutants, Mode of action, Water quality, Analytical techniques, Bioassay, *Absorption, Growth stages, Isotopes, Organic compounds, Fish eggs, Juvenile fish. Identifiers: *Plaice, *Pleuronectes platessa*, Bioaccumulation, Tissue analysis.

The accumulation of organic mercury from sea water by plaice (*Pleuronectes platessa*) eggs, larvae and adult fish was studied using labeled $\text{CH}_3\text{-HgCl}$ as a tracer. The isotope was rapidly accumulated, the largest fraction taken up by muscle tissue. High concentration factors were attained by many internal organs, particularly blood, spleen, and kidney. Longer biological half-times than previous estimates with labeled HgCl_2 were obtained. The possible consequences of inorganic mercury accumulated from sea water being excreted at the rate of methylmercury were calculated. (Katz)

W77-06607

ROTARY-FLOW TECHNIQUE FOR TESTING FITNESS OF FISH,

Uppsala Univ. (Sweden). Inst. of Zoophysiology. P. E. Lindahl, S. Olofsson, and E. Schwanbom.

Biological Monitoring of Water and Effluent Quality, ASTM STP 607, p. 75-84, 1977. 3 fig, 9 ref.

Descriptors: *Design, *Methodology, *Laboratory tests, Water pollution, Water quality, Toxins, Research and Development, *Water temperature, Thermal properties, Fish physiology, Tolerance, Laboratory equipment. Identifiers: *Fish fitness, *Cod, *Salmo salar*, *Ethanol.

An improved version of rotary-flow apparatus which allowed tests of fitness with fish of different size at constant temperature was described. Optimal experimental conditions were investigated with cod. The method was applied to the study of the influence of temperature on the effect of ethanol in cod and to comparison of the fitness of cod from an inconsiderably contaminated and a polluted area. (Katz)

W77-06608

A BIOLOGICAL MONITORING SYSTEM EMPLOYING RHEOTAXIS OF FISH,

Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (West Germany).

W. K. Besch, A. Kemball, K. Meyer-Waarden, and B. Scharf.

Biological Monitoring of Water and Effluent Quality, ASTM STP 607, p. 56-74, 1977. 10 fig, 17 ref.

Descriptors: *Design, *Monitoring, *Laboratory tests, *Methodology, Toxicity, Toxins, Lethal limit, Fish physiology, *Fish behavior, Water quality, Water pollution, *Carp. Identifiers: *Rheotaxis, Surfacing, Biological monitoring system, Acute poisoning, Toxicology, Specific toxic effects.

An automatic toxicity monitoring and alarm device using rheotaxis was described. The device was also used for static laboratory tests. When loss of rheotaxis along with surfacing were used for

criteria for acute poisoning instead of death, the time required for toxicity tests was shortened. Visual observation of other parameters of behavior, such as schooling, yielded other information pertinent to the specific effects of certain toxins or particular concentrations of toxins. Loss of rheotaxis and surfacing was recorded automatically. Testing of the automatic monitoring device in the laboratory led to the development of a multichannel, automatically recording test apparatus. (Katz)

W77-06609

AN ELECTRONIC SYSTEM TO MONITOR THE EFFECTS OF CHANGES IN WATER QUALITY ON FISH OPERCULAR RHYTHMS,

National Inst. for Water Research, Pretoria (South Africa).

W. S. G. Morgan.

Biological Monitoring of Water and Effluent Quality, ASTM STP 607, p. 38-55, 1977. 8 fig, 1 tab, 13 ref.

Descriptors: *Monitoring, *Toxicity, *Methodology, *Water quality, *Design, Water pollution, Analytical techniques, Fish behavior, Electrical equipment, Fish physiology, Toxicity, Data collection. Identifiers: Critical toxic condition, Biological automatic monitoring system, Electronic monitoring system, *Opercular rhythms (Fish), Water quality changes.

A rapid automated biological monitoring system intended to complement physical-chemical monitoring techniques was developed utilizing the fact that fish opercular rhythms increase under toxic conditions. Any increase above the expected rate under normal conditions was electronically monitored. A built-in visual alarm system served as an advance warning of the development of a toxic condition. The system was also able to control toxic industrial discharges, thus aiding the preservation of receiving water quality. (Katz)

W77-06610

LAS INHIBITION OF DIFFUSION AND UPTAKE OF TRITIATED URIDINE DURING TELEOST EMBRYOGENESIS,

Loyola Univ. of Chicago, Ill.

H. W. Manner, and C. Muehleman.

Environmental Biology of Fish, Vol. 1, No. 1, p. 81-84, 1976. 2 tab, 1 fig, 13 ref.

Descriptors: *Mode of action, *Bioassay, *Embryonic growth stage, *Water pollution effects, *Surfactants, *Linear alkylate sulfonates, *Membrane processes, *Analytical techniques, *Tritium, *Absorption, Laboratory tests, Detergents, Sulfonates, Teleosts, Minnows, Permeability, Radioactivity, Radioisotopes, Inhibitors, Fish reproduction. Identifiers: *Embryogenesis, *Pimephales promelas, *RNA synthesis, *Uridine.

Fathead minnow embryos (*Pimephales promelas*) of 5 different developmental ages (5, 33, 48, 72 and 96 hours after fertilization) were used as controls and exposed for 2 hours to a solution of 0.25 microCi per ml of tritiated uridine. Another set of embryos of the same ages were subjected to the same regimen except that during the one hour immediately preceding the uridine incubation, the control embryos were placed in water while experimental embryos were placed in water containing 15 ppm 11.2 LAS. In both cases, radiation counts per minute per embryo and per milligram of embryo increased over the 4 day developmental period. The embryos with LAS regimens displayed lower radiation counts at all ages as compared to controls, indicating an inhibition of diffusion and uptake of tritiated uridine and/or RNA synthesis. The possible mechanism of LAS is discussed. (Katz)

W77-06611

EFFECT OF MALACHITE GREEN AND FORMALIN ON THE SURVIVAL OF LARGEMOUTH BASS EGGS AND FRY,

Cheraw National Fish Hatchery, S. C.

L. D. Wright.

The Progressive Fish-Culturist, Vol. 38, No. 3, p. 155-157, 1976. 2 tab, 14 ref.

Descriptors: *Bass, *Fish eggs, *Fry, *Toxicity, *Fungicides, Juvenile fish, Fish hatcheries, Fish parasites, Pathogenic fungi, Incubation, Laboratory tests, Mortality, Fish diseases, Bioassay. Identifiers: *Micropterus salmoides*, *Malachite green, *Formalin, *Saprolegnia*.

Largemouth bass eggs and fry were exposed to various concentrations of malachite green and formalin. Formalin could safely be used as a fungus control for the eggs at the standard concentration of 4,000 ppm for 10 minutes, and the fry could safely be prophylactically treated at 50 ppm for 60 minutes. Malachite green proved to be extremely toxic and should not be used as a fungicide or prophylactic.

W77-06612

A PNEUMATIC GRAB FOR OBTAINING LARGE, UNDISTURBED MUD SAMPLES: ITS CONSTRUCTION AND SOME APPLICATIONS FOR MEASURING THE GROWTH OF LARVAE AND EMERGENCE OF ADULT CHIRONOMIDAE,

Institute of Terrestrial Ecology, Edinburgh (Scotland). Wetlands Research Group.

For primary bibliographic entry see Field 5A.

W77-06613

THE EFFECTS OF METHOXYCHLOR ON RIFFLE INVERTEBRATE POPULATIONS AND COMMUNITIES,

Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.

P. J. Eisele, and R. Hartung.

Transactions of American Fisheries Society, Vol. 105, No. 5, p. 628-633, 1976. 2 tab, 3 fig, 17 ref.

Descriptors: Streams, *Toxicants, *Pesticides, *Invertebrates, *Biological communities, *Bottom sampling, *Benthic fauna, *On-site investigations, Water pollution effects, Environmental effects, Stoneflies, Diptera, Ecosystems, Artificial substrates. Identifiers: *Methoxychlor, *Riffle invertebrates, Baetids.

A study was conducted to evaluate the chronic effects of a toxicant on interacting stream invertebrate populations. The study involved the continuous dosing of a small stream at 0.2 micrograms per liter methoxychlor for over one year. Invertebrate populations were monitored by artificial substrate and bottom sample collections of riffle invertebrates. Most invertebrate populations experienced some reduction due to the stream dosing. Some taxa (baetids and plecopterans) were effected as reflected by population reductions in dosed areas. Many taxa (hydropsychids, simuliids and aeschnids) were temporarily affected, experiencing initial population reductions in dosed areas but then recovering to control levels. Other taxa (chironomids and elmidids) were not affected. The riffle invertebrate community colonizing artificial substrates experienced a temporary decrease in bottom sample collections. In general, most longterm effects were minor in comparison to naturally occurring phenomena such as flooding. (Katz)

W77-06614

DYNAMICS OF MICRO-ZOOPLANKTON POPULATIONS TREATED WITH COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,

California Univ., San Diego, La Jolla. Inst. of Marine Resources.

For primary bibliographic entry see Field 5A.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

W77-06616

EVALUATION OF POTENTIAL INDICATORS OF SUB-LETHAL TOXIC STRESS ON MARINE ZOOPLANKTON (FEEDING, FECUNDITY, RESPIRATION AND EXCRETION): CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
For primary bibliographic entry see Field 5A.
W77-06617

THE GROWTH OF YOUNG SALMONIDS (ONCHORHYNCHUS KETA): CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 5A.
W77-06618

EXPERIMENTAL OBSERVATIONS ON THE EFFECTS OF COPPER ON COPEPODS AND OTHER ZOOPLANKTON: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.
For primary bibliographic entry see Field 5A.
W77-06619

RESPONSE OF MACRO-ZOOPLANKTON POPULATIONS TO COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5A.
W77-06620

EFFECTS OF COPPER ON SILICIC ACID UPTAKE BY A MARINE PHYTOPLANKTON POPULATION: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 5A.
W77-06621

RESPONSE OF NATURAL MARINE BACTERIAL POPULATIONS TO COPPER: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5A.
W77-06622

EFFECTS OF FOUR OILS ON MARINE BACTERIAL POPULATIONS: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5A.
W77-06623

EFFECTS OF COPPER ON PHYTOPLANKTON STANDING CROP AND PRODUCTIVITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5A.
W77-06624

EFFECTS OF COPPER ON THE DOMINANCE AND THE DIVERSITY OF ALGAE: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5A.
W77-06625

TEMPERATURE, SALINITY AND LIGHT PENETRATION STRUCTURES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT.
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 5A.
W77-06626

LOCH EWE BAG EXPERIMENT, 1974.
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5A.
W77-06627

TOXICITY OF FLUORIDE TO BROWN TROUT FRY (SALMO TRUTTA).
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
D. A. Wright.
Environmental Pollution, vol. 12, p. 57-62, 1977; 3 fig., 10 ref.

Descriptors: *Absorption, *Brown trout, *Fry, *Hardness(Water), *Toxicity, *Bioassay, *Lethal limit, *Fluorides, Juvenile fish, Trout, Salmonids, Rainbow trout, Mortality, Laboratory tests, Fluoridation, Industrial wastes.

The toxicity of fluoride to brown trout fry (*Salmo trutta*) was tested using groups of 100 animals in tapwater containing 29 ppm calcium with sodium fluoride added. Results obtained were similar to published work on *S. gairdneri* which showed a distinct fall in mortality rates below 20 mg/litre fluoride. Fluoride uptake was the same in dead fish taken from the toxicity testing aquaria and live fish. Concentration factors (animal fluoride concentrations:external fluoride concentrations) were small, reaching a maximum of 2.3 in animals in 5 mg/litre fluoride after 160 h. (Katz)
W77-06628

THE UPTAKE OF LEAD, ZINC, CADMIUM, AND COPPER BY THE PULMONATE MOLLUSC, HELIX ASPERSA MULLER, AND ITS RELEVANCE TO THE MONITORING OF HEAVY METAL CONTAMINATION OF THE ENVIRONMENT.
Bristol Univ. (England). Dept. of Botany.
P. J. Coughtrey, and M. H. Martin.
Oecologia, vol. 27, p. 65-74, 1977. 1 fig., 5 tab., 53 ref.

Descriptors: *Lead, *Zinc, *Cadmium, *Copper, *Absorption, *Animal physiology, *Mollusks, *Heavy metals, *Water pollution sources, Monitoring, Size, Invertebrates, Path of pollutants, Growth stages.
Identifiers: Bioaccumulation, *Helix aspersa, Terrestrial mollusks, Body weight(Mollusks).

The occurrence of lead, zinc, cadmium, and copper in individuals of *Helix aspersa* from two sites of varying degrees of contamination was studied. Zinc, cadmium, and copper were shown to increase to a linear fashion with animal weight. The rate of uptake for zinc and cadmium in particular was significantly greater at the more contaminated site. Statistical analysis of the data, using correlation and regression techniques provided information on apparent intermetallic effects. Because metal uptake and body weight show a positive linear relationship only the use of animals of similar weight and/or size can be used for monitoring purposes. Even then, different patterns of uptake into different organs and interactions between metal uptakes are such as to seriously question the use of *Helix*, and other molluscs, for monitoring purposes unless specific organs from comparably sized and/or aged animals are used. (Katz)
W77-06629

THE TOXIC EFFECTS OF SELECTED HEAVY METALS ON UNADAPTED POPULATIONS OF VORTICELLA CONVALLARIA VAR SIMILIS.
Surrey Univ., Guildford (England). Dept. of Microbiology.
D. P. Sartory, and B. J. Lloyd.
Water Research, Vol. 10, p. 1123-1127, 1976. 1 fig., 2 tab., 10 ref.

Descriptors: *Toxins, *Toxicity, *Heavy metals, *Protozoa, *Metals, Lethal limit, Water pollution sources, Mortality, Path of pollutants, Environmental effects, Laboratory tests, Sewage effluents, *Lead, *Mercury, *Zinc, Mode of action. Identifiers: Bioaccumulation, *Vorticella convallaria var similis, Free metal ions.

Unadapted populations of *Vorticella convallaria* var *similis*, a sessile peritrich protozoan found abundantly in healthy rivers, activated sludge, percolating filters and slow sand filters were subjected to a range of concentrations of three common pollutant metals. These populations were killed by concentrations of and above, 0.0005 mg/l. of the free metal ion of either lead or mercury. Colonies were also killed by concentrations of, and above, 0.075 mg/l. of the free metal ion of zinc, 12 hr 50% lethal doses were calculated, and for *V. convallaria* var *similis* were 0.00036 mg/l. for lead, 0.005 mg/l. for mercury and 0.29 mg/l. for zinc. (Katz)
W77-06636

CHLORINE REACTIONS WITH SEAWATER CONSTITUENTS AND THE INHIBITION OF PHOTOSYNTHESIS OF NATURAL MARINE PHYTOPLANKTON.
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
R. W. Eppley, E. H. Renger, and P. M. Williams.
Estuarine and Coastal Marine Science, Vol. 4, p. 147-161, 1976. 6 fig., 6 tab., 25 ref.

Descriptors: *Chlorine, *Chlorination, *Cooling water, *Water pollution sources, *Plankton, *Phytoplankton, Inhibition, Photosynthesis, Sea water, Salinity, Condensers, Water quality, Environmental effects, Analytical techniques, Growth rates.
Identifiers: Hypochlorite, *Skeletonema costatum*.

The time course of chlorine disappearance was followed in filtered (1), non-filtered (2), and u.v.-oxidized (3) seawater. In (1) and (2) there was an initial rapid decline in both free and residual chlorine followed by a slower decline of these species. No decline was observed in (3), suggesting that the removal of organic matter and/or the oxidation of metal ions by u.v.-oxidation removed those molecular species that reacted with chlorine. Reaction rate was more rapid in (2) than in (1), suggesting that particulate organic matter may also react with chlorine. Reaction kinetics of chlorine were complex but approximated second order in the slow phase. The inhibition of phytoplankton photosynthesis by chlorine was studied by adding hypochlorite to samples. Chlorine concentrations required for 50% inhibition varied with exposure time. For 24-h incubations such inhibitions took place with residual chlorine concentrations of 10 parts/10 to the 9th power. The inhibition appeared to be irreversible. The deleterious impact on marine phytoplankton by the use of seawater for cooling power plants lay in the use of chlorine to prevent slime build-up on the condenser system parts. (Katz)
W77-06637

THE FAUNA OF THE POLLUTED RIVER TEES ESTUARY.
Leeds Univ. (England). Wellcome Marine Lab.
J. S. Gray.
Estuarine and Coastal Marine Science, Vol. 4, p. 653-676, 1976. 8 fig., 8 tab., 62 ref.

Descriptors: *Estuaries, Water pollution, *Water pollution sources, *Productivity, Community development, Biomass, Worms, Algae, Population, Growth rates, Distribution patterns, *Environmental effects, Succession, Bacteria, Ecology, Wildlife, Invertebrates, Annelids, Food chains, *Nematodes, Ecosystems, Biological communities, Ecological distribution, *Gastropods. Identifiers: Polychaetes, *River Tees estuary(England).

The fauna at the mouth of the grossly polluted river Tees estuary, England, was surveyed in summer 1971 and spring 1973. Gastrotrichs and nematodes dominated numerically and were more abundant within the estuary than at open coast beaches, (2×10 to the 6th power compared with 8×10^0 animals sq m). Few environmental factors correlated with faunal abundance. Sewage bacteria showed a positive correlation with gastrotrichs at open coast beaches and a negative correlation at sheltered beaches, whereas nematodes showed a positive correlation with sewage bacteria at a sheltered sand beach and a negative correlation at a muddy beach. Annelids did not show correlations with granulometric factors and comprised 98% of the biomass of the muddy area. Using data on annelid species, diversity patterns and a variety of multivariate analyses all showed that at the muddy Seal Sand, a central area could be distinguished from a peripheral area. The central area was physically stable and was covered by an algal mat. This area contained the polychaetes *Capitella capitata*, *Polydora ciliata*, *Streblospio shrubsolei* and *Manayunkia aestuarina* and the oligochaetes *Pelocolex benedeni* and *Tubifex pseudogaster*. The macrofauna comprised fewer species when compared with a survey done in 1935; in particular there were fewer species of polychaetes. There were no detectable effects of pollution on the meiofauna; the numbers of organisms and total biomass were comparable with those of other temperate estuaries. (Katz) W77-06638

TISSUE ACCUMULATION AND ENZYMATIC EFFECTS OF HEXAVALENT CHROMIUM IN RAINBOW TROUT (SALMO GAIARDNERI). Battelle Pacific Northwest Labs., Richland, Wash. D. R. Buhler, R. M. Stokes, and R. S. Caldwell. Journal of the Fisheries Research Board of Canada, Vol. 34, p. 9-18, 1977. 6 tab, 1 fig, 27 ref.

Descriptors: *Chromium, *Freshwater fish, Salmonids, *Rainbow trout, *Laboratory tests, *Biochemistry, *Bioassay, Enzymes, *Water pollution effects, Path of pollutants, Toxicity, Mortality, Cooling water, *Fish physiology, Biochemistry, Columbia River. Identifiers: *Hexavalent chromium, Whole body residues, Skeletal muscle tissue.

Two-year-old rainbow trout (*Salmo gairdneri*), reared for 2 yr in water containing about 0.00025 mg/l hexavalent chromium (Cr^{+6}) (Naches trout) or between 0.002 and 0.01 mg/l Cr^{+6} (Hanford trout) accumulated appreciable chromium, yielding whole body residues of about 0.029 and 0.18 micrograms/g wet tissue, respectively. Highest concentrations were in the opercular bone, spleen, kidney, gastrointestinal tract, and gall bladder. Short-term exposure of Hanford trout to 2.5 mg/l Cr caused a rapid additional increase of tissue chromium, but at 22 days whole body levels were only 0.87 micrograms/g. Upon return of exposed fish to water containing 0.002-0.01 mg/l chromium, the metal was rapidly depleted from most tissues except kidney, liver, gall bladder, and bile. Chromium accumulated in tissues of trout exposed to 2.5 mg/l Cr was not distributed proportionally among the various subcellular fractions but concentrated in the cell cytosol, especially in the liver and gill. Mitochondrial cytochrome oxidase, NADH-cytochrome c reductase, and succinate cytochrome c reductase activities in liver, kidney, gill, and brain tissues of Naches trout, Hanford trout, and Hanford trout exposed to 2.5 mg/l Cr

were not significantly different except for kidney NADH-cytochrome c reductase which was lower in Hanford and chromium treated fish. Microsomal nitroreductase, O-demethylase and NADPH-cytochrome c reductase and the soluble glucose-6-phosphate dehydrogenase activities in liver and kidney from Hanford trout were significantly lower than those of Naches trout. Exposure of Hanford trout to 2.5 mg/l Cr, however, did not reduce the activities of these enzymes below control levels. In vitro studies showed that trout enzymes were fairly insensitive to Cr inhibition. These results suggest that observed differences in enzyme activity between Naches and Hanford trout may be caused by factors other than chromium content of the water. (Katz) W77-06639

STABLE ELEMENTS OF RADIOECOLOGICAL IMPORTANCE IN CERTAIN ECHINODERM SPECIES. Democritus Nuclear Research Center, Athens (Greece). Chemistry Dept. For primary bibliographic entry see Field 5A. W77-06640

EFFECTS OF PRESSURE, TEMPERATURE AND OXYGEN ON THE OXYGEN-CONSUMPTION RATE OF THE MIDWATER COPEPOD GAUSSIA PRINCEPS. California Univ., Santa Barbara. Marine Science Inst. J. J. Childress. Marine Biology, Vol. 39, p. 19-24, 1977. 1 tab, 3 fig, 22 ref.

Descriptors: *Copepods, *Plankton, Marine organisms, *Oxygen requirements, California, Water properties, *Pressure, *Temperature, *Vertical migration, Diurnal, Laboratory tests, Methodology, Animal physiology. Identifiers: *Gaussia princeps*, *Calanoid copepod, *Oxygen minimum layer, Anaerobic metabolism.

Gaussia princeps is a diurnal vertical migrator which spends its days below 400 m in the oxygen minimum layer and migrates to shallower depths (200 to 300 m) at night. This species' consumption was measured at 3.5, 7 and 10°C and 1, 14, 28, 61, 121, and 181 atm of hydrostatic pressure (1 atm corresponds to approximately 10 m of depth). The Q_{10} of the oxygen consumption is higher at lower temperatures and higher pressures. Hydrostatic pressure has significant effects on the oxygen-consumption rate at pressures as low as 28 atm. At all temperature and pressure combinations, *G. princeps* displays a very low metabolic rate compared to shallow living copepods. The critical oxygen partial pressure for this species is about 10 to 13 mm Hg O_2 at 10, 7 and 5.5°C. Based on these data, a predicted relation between depth and oxygen consumption by this species off California, USA, is presented. This shows a higher oxygen-consumption rate at the nighttime depths and a much lower, partially anaerobic metabolism at the daytime depths. (Katz) W77-06642

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY. Bendix Aerospace Systems Div. Ann Arbor, Mich. For primary bibliographic entry see Field 5A. W77-06665

MEASUREMENTS OF PLANKTONIC BIOMASS IN A RESERVOIR. Oklahoma State Univ., Stillwater. Dept. of Zoology. For primary bibliographic entry see Field 5A. W77-06679

LIMNOLOGICAL AND PLANKTONIC STUDIES IN THE WATERTON LAKES, ALBERTA. Canadian Wildlife Service, Edmonton (Alberta). R. S. Anderson, and R. B. Green. Canadian Wildlife Service, Occasional Paper No. 27, 1976. 41 p. 13 fig., 6 tab., 62 ref. (Published in Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 571-579, 1975).

Descriptors: *Biological communities, *Baseline studies, *Zooplankton, *Phytoplankton, Canada, Water chemistry, Winds, Water circulation, Hydrologic cycle, Histograms, Varieties, Water pollution effects, Human population, Limnology. Identifiers: *Waterton Lakes(Alberta), Upper Waterton Lake(Alberta), Lower Waterton Lake(Alberta), Knight's Lake(Alberta).

The major lakes of Waterton Lakes National Park in southwestern Alberta (Canada), Upper and Lower Waterton and Knight's Lakes, were investigated to determine the extent of their enrichment due to their central location in the park, the townsites, and the major campground facilities on their shores. The water renewal rate of Upper Waterton Lake is .8 times per year; lower Waterton's rate is 7.1 and Knight's Lake is 161. A total of 164 species and subspecies of algae were identified in the lakes during 1972-1975. Zooplankton included 19 crustacean and 12 rotiferan species, and their composition appears to have remained unchanged since 1973, although abundance has increased, as have the phytoplankton abundance and species numbers. The physical conditions and chemical constituents have remained fairly constant although some nutrient enrichment was evident. New sewage treatment facilities at the townsites, which contains a resident population of 120 but peaks to 510,086 annually, are expected to eliminate the cultural nutrient source, although, when compared to the lake volume, it is relatively small. However, it may have been responsible for recent increases in plankton abundance. (Auen-Wisconsin). W77-06680

STRATIFICATION OF KINETIC ORIGIN AND ITS BIOLOGICAL CONSEQUENCES IN A NEOTROPICAL MAN-MADE LAKE. Warsaw Univ. (Poland). Dept. of Hydrobiology. For primary bibliographic entry see Field 2H. W77-06683

A GENERAL MODEL OF MICROBIAL GROWTH AND DECOMPOSITION IN AQUATIC ECOSYSTEMS. Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst. L. S. Clesceri, R. A. Park, and J. A. Bloomfield. Rensselaer Polytechnic Institute FWI Report 77-2, January 1977. 35 p. 7 fig., 4 tab., 38 ref. NSF AG-199, BMS76-00761.

Descriptors: *Mathematical models, *Computer models, *Microbial degradation, Microorganisms, Organic matter, Lakes, Detritus, Cycling nutrients, Simulations. Identifiers: Computer model CLEANER, *Lake George(NY).

A microbial decomposition mathematical model which represents the dual role of microflora as a food source and as an agent of biogeochemical cycling in the pelagic portion of a lake has been developed as an adjunct to the ecosystem model CLEANER. The model represents microbial processes with greater realism than most existing ecosystem models and shows promise of applicability under varying conditions. The model conceptualizes the microbial growth and decomposition compartments by WRDOM-refractory dissolved organic matter in water; WLDOM-labile dissolved organic material in water; WDEC-decomposers in water; DDEC-decomposers of detritus; DDOM-dissolved organic material or detritus; POM-particulate organic material; and

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

DIM-dissolved inorganic material. It is amenable to detailed inspection for holistic relationships that are not evident when each process is considered separately under experimental conditions, and is most useful in simulating ecosystem responses to environmental perturbations, and in determining the sensitivity of the ecosystem to variations in the components and processes that constitute the microbial decomposition subsystem. For example, it can be used to consider the availability of various classes of dissolved organic matter and the differential rates of uptake by decomposing microorganisms as modified by natural environmental variations throughout the year. Sensitivity analyses can be readily performed using the interactive capability of the model on a time-sharing computer system. (Auen-Wisconsin)
W77-06684

DYNAMICS OF PHYTOPLANKTON BIOMASS IN TWO LAKES OF DIFFERENT LIMNOLOGICAL CHARACTER.
Instytut Przyrodniczych Podstaw, Lubin (Poland).
Produkcyj Roslinnej AR.
W. Wojciechowska.
Ekologia Polska, Vol. 24, No. 2, p. 237-252, 1976. 6 fig., 1 tab., 35 ref.

Descriptors: *Phytoplankton, *Biomass, *Trophic level, Europe, Eutrophication, Mesotrophy, Seasonal, Temporal distribution, Productivity, Foreign countries, Nannoplankton, Lakes.
Identifiers: *Lake Piaseczno(Poland), *Lake Biczke(Poland).

Seasonal dynamics of phytoplankton biomass were investigated during 1971-1972 in alpha-mesotrophic Lake Piaseczno and in eutrophic Lake Biczke in Poland. Biomass values were lowest in winter and highest in summer with qualitative seasonal variability primarily expressed by changes in the communities' taxonomic structure. Cyanophyta and Bacillariophyceae dominated in spring and summer; in the other seasons Cryptophyceae, Bacillariophyceae, of the phytoplankton were also similar in both lakes. The nannoplankton biomass and its contribution to total biomass were highest from late autumn till early spring. The different trophic levels of the lakes were reflected in the biomass variations, as biomass concentration in a water volume unit was usually higher in Lake Biczke. The frequently observed biomass concentration in the metalimnion of Lake Piaseczno is characteristic for lakes in the oligotrophic range. The species diversity and nannoplankton contribution to biomass were higher in the mesotrophic lake. The range of biomass changes within a year was higher in both lakes in 1971 than in 1972. In Lake Piaseczno it was 1:59 in 1971 and 1:7 in 1972 and in Lake Biczke 1:1057 and 1:74, respectively. (Auen-Wisconsin)
W77-06685

THE MINING FAUNA IN FOUR MACROPHYTE SPECIES IN MIKOLAJSKIE LAKE.
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
E. Urban.
Ekologia Polska, Vol. 23, No. 3, p. 417-435, 1975. 5 fig., 10 tab., 15 ref.

Descriptors: *Aquatic plants, *Parasitism, *Insects, *Oligochaetes, Diptera, Worms, Varieties, Mode of action, Europe, Foreign countries, Lakes.
Identifiers: *Borer fauna, Lepidoptera, Hydrocarina, Potamogeton, Elodea canadensis, Myriophyllum spicatum, Glyptotendipes, Mikolajskie Lake(Poland).

Research in Poland's Mikolajskie Lake details composition, distribution, seasonal variation, and effects of mining fauna infesting Potamogeton lucens, P. perfoliatus, Elodea canadensis and Myriophyllum spicatum. Of 22 borers identified, the dominant group in P. perfoliatus and P. lucens

was Chironomidae; the dominant borers of E. canadensis and M. spicatum were the larvae of Lepidoptera and Glyptotendipes gripekoveni. Clear differences were observed in the mining rate between the individual parts of plants. In P. lucens and P. perfoliatus the highest infestation rate was recorded in the stems, then in the leaf veins, with the leaf blades showing the lowest infestation rate. In E. canadensis and M. spicatum mining was restricted to the stems with lower infestation rates in the pondweed stems. Infestation rates in plants of the same species growing in different depths differed. The fauna lived in mines differing in shape and number of openings. The loss of stem tissue due to the mining activity for P. perfoliatus was 13.2%, in P. lucens 6.5%, in E. canadensis 1.2% and in M. spicatum 0.3% of wet weight. (Auen-Wisconsin)
W77-06688

LAKE RESTORATION BY BOTTOM WATER SIPHONING (IN GERMAN).
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland). Marine Research Lab.
For primary bibliographic entry see Field 5G.
W77-06689

THE INFLUENCE OF ACROLEIN AND HYDROCRYLE ON THE DEVELOPMENT DYNAMICS OF AQUATIC BACTERIA.
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
A. Starzecka.
Acta Hydrobiologica, Vol. 17, No. 4, p. 391-403, 1975. 4 fig., 3 tab., 6 ref.

Descriptors: *Toxicity, *Aquatic bacteria, Bacteria, Lethal limit, Cooling water, Cooling towers, Streams, Thermal powerplants, Pseudomonas, Pipe flow, Fouling.
Identifiers: *Acrolein, *Hydrocrole, Trzebunka Stream(Poland), Achromobacter-Alcaligenes.

Acrolein and hydrocrole were used to control the excessive, objectionable development of bacteria in the condenser pipes at a power station. This study analyzes the influence of these toxic substances on the development of bacteria occurring in the clean water of the Trzebunka Stream and the polluted water flowing through the thermal power station condensers. It was concluded that: (1) Pure strains of bacteria were less resistant to the action of acrolein than mixed populations; (2) nutritive enrichment of the water decreased the influence of acrolein and hydrocrole; (3) bacteria from clean water was more sensitive to the toxic substances than populations from polluted waters; (4) hydrocrole was more toxic to bacteria than acrolein; (5) acrolein underwent a biological as well as chemical degradation in an aquatic environment; (6) doses of 1000 mg/l of acrolein and 580 mg/l of hydrocrole caused a lethal effect on mixed populations of bacteria in the condenser water; (7) non-lethal concentrations introduced a temporary inhibition of the bacterial growth; (8) non-lethal concentrations should be applied every 24 hours in order to decrease the number of bacteria in the cooling system water; and (9) the use of too low concentrations was dangerous since it could induce the formation of resistant populations. (Luedtke-Wisconsin)
W77-06690

THE SHARE OF ALGAE WITH DIFFERENT DIMENSIONS IN THE PLANKTON OF TWO LAKES OF DIFFERENT TROPIC CHARACTER IN THE ANNUAL CYCLE.
Instytut Przyrodniczych Podstaw, Lubin (Poland).
Produkcyj Roslinnej AR.
W. Wojciechowska.
Acta Hydrobiologica, Vol. 18, No. 2, p. 127-138, 1976. 3 fig., 1 tab., 13 ref.

Descriptors: *Lakes, *Phytoplankton, *Biomass, Trophic level, Algae, Nannoplankton, Seasonal.
Identifiers: *Lake Piaseczno(Poland), *Lake Biczke(Poland).

The seasonal variations of the numbers and biomass of the phytoplankton in two lakes, a eutrophic, pond type lake and a deep, alpha-mesotrophic lake, are presented along with the changes of the share of different fractions of phytoplankton in total numbers and biomass. Phytoplanktonic organisms were divided into 3 fractions according to linear size: less than 20 micrometers, 20-60 micrometers and greater than 60 micrometers. It was found that the microplankton decided the total biomass even if the nannoplankton appeared in superior numbers. In Lake Piaseczno the smallest algal fraction had a significant share in the total biomass only during spring. The biomass of algae less than 20 micrometers decreased during the summer and autumn which caused a predominance of the greater than 20 micrometer fractions. It was found that the range of changes in the total phytoplankton biomass of the lakes confirmed the estimation of their trophic type. In the rich pond-like Lake Biczke the extreme annual values of biomass was 1:1.057 whereas similar values for the alpha-mesotrophic Lake Piaseczno were only 1:60. The significant quantity of nannoplankton in Lake Piaseczno showed that the lake was poor and almost oligotrophic. A much smaller share of nannoplankton was found in Lake Biczke during the warm seasons. (Luedtke-Wisconsin)
W77-06692

PRESENTING TRENDS IN LAKE EUTROPHICATION.
CBA Engineering Ltd., Vancouver (British Columbia).
S. Hershman, and S. O. Russell.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. EE6, p. 1281-1285, 1976. 2 fig., 2 tab., 2 ref.

Descriptors: *Eutrophication, *Methodology, *Projections, Forecasting, Estimating, *Canada, Decision making, Water quality, Phosphorus, Nutrient removal, Lakes, Risks.
Identifiers: *Skaha Lake(British Columbia), Phosphorus loading.

A procedure developed to define probable trends in water quality in Skaha Lake, British Columbia, is presented. The method, based on the concepts of Bayesian decision theory, takes into account uncertainty, provides a way of combining information obtained from individual experts, and presents the results in a way that can be generally understood. It allows the vast amount of available quantitative and qualitative information to be condensed into a form that could be understood and used as a basis for action by decision makers. Skaha Lake has a surface area of 5000 acres, a mean depth of 85 ft, an average flushing time of 1.2 yr, and is becoming eutrophic. Because of the direct relationship between phosphorus loading and water quality in the lake, the procedure for predicting future water quality under alternative management schemes was relatively straightforward. It involved categorizing the water quality into seven discrete trophic states; establishing a relationship in the form of a probability bond between nutrient loading and water quality; and combining it with nutrient forecasts under various management alternatives to obtain estimates of probable future water quality states. Results are presented in a probability matrix assuming a skew normal distribution for the case where sewage treatment continues at the 1971 level and for an alternative where 80% of the phosphorus is removed. (Luedtke-Wisconsin)
W77-06693

ECOLOGICAL RELATIONS BETWEEN INVERTEBRATES AND SUBMERGED MACROPHYTES IN THE LAKE LITTORAL, Warsaw Univ. (Poland). Dept. of Hydrobiology. G. J. Soszka. *Ekologia Polska*, Vol. 23, No. 3, p. 393-415, 1975. 7 fig., 4 tab, 50 ref.

Descriptors: *Invertebrates, *Littoral, *Lakes, Oligochaetes, Submerged plants, Pondweeds, Aquatic plants, Plant growth, Food habits, Reproduction, Aquatic animals. Identifiers: *Macrophytes, *Mikolajskie Lake (Poland), *Potamogeton perfoliatus, *Potamogeton lucens, *Myriophyllum spicatum, *Elodea canadensis, Relationships.

The ecological relations between the invertebrates and submerged macrophytes, *Potamogeton perfoliatus*, *P. lucens*, *Myriophyllum spicatum*, and *Elodea canadensis*, in the littoral zone of Mikolajskie Lake are studied, with emphasis on feeding of invertebrates, use of macrophytes by fauna during reproduction and development, and influence of invertebrates on submerged macrophytes. Results indicated that the invertebrates most strongly related to the plants were the Lepidoptera larvae, *Limnephilus* sp., *Phryganea grandis*, and to a lesser extent the Chironomidae larvae and *Radix ovata*. The Oligochaeta which are very abundant on macrophytes were weakly associated with plants. Macrophytes were used by invertebrates more as a life substrate than as food. The relations of the majority of invertebrates with macrophytes were not permanent and the macrophytes could be substituted by another substrate. The life activity of invertebrates caused varying damage to the macrophytes, with pondweeds destroyed to a much greater extent than *E. canadensis* or *M. spicatum*. *P. perfoliatus* and *P. lucens* were used more by fauna than *E. canadensis* and *M. spicatum*. These interrelations revealed a dynamic character and changed over the year. (Luedtke-Wisconsin) W77-06694

A STUDY ON THE ROLE OF HERBIVOROUS ZOOPLANKTON COMMUNITY AS PRIMARY CONSUMERS OF PHYTOPLANKTON IN DUTCH LAKES, R. D. Gulati. *Verhandlungen Internationale Vereinigung Limnologie*, Vol. 19, Part II, p. 1202-1210, 1975. 2 fig., 3 tab., 27 ref.

Descriptors: *Lakes, *Zooplankton, *Phytoplankton, *Food chains, Trophic level, Food pyramids, Digestion, Primary production, Respiration, Animal physiology, Biomass, Standing crops, Foreign research, Foreign countries, Water chemistry. Identifiers: *Lake Vechten (Netherlands), *Lake Tjeukemeer (Netherlands).

As a counterpoint to most field studies of zooplankton productivity that are oriented toward population dynamics, research is offered on the trophic relationship of zooplankton with algae, bacteria and detritus in aquatic environments. The study is the first attempt to compare the ingestion, assimilation, respiration and production rates of the herbivorous zooplankton in Lake Vechten and Lake Tjeukemeer during 1972-73. Lake Vechten, a 4.7 hectare, isolated deep dug-out pit that exhibits hypolimnetic oxygen depletion and nutrient accumulation, has nutrient-poor epilimnetic waters, high transparency, and a great diversity of phytoplankton species despite relatively moderate production and biomass. Lake Tjeukemeer is a 21 sq km shallow lake connected to the Friesian water system, with water rich in dissolved humic compounds and low transparency. Tjeukemeer is nutrient rich and the sharp seasonal oscillations in the water chemistry are governed by the hydrological regime in the area. Sampling on both lakes was done at fortnightly intervals. Ingestion and assimilation rate experiments were made with lake

phytoplankton as carbon-14 tracer food. Standing crop biomass and total zooplankton were estimated, and the biomass of filter feeders was obtained indirectly from the zooplankton data. Zooplankton oxygen consumption rates were measured by potentiometer. All other parameters—physicochemical conditions of the water, chlorophyll, primary production, etc.—were measured in a laboratory as part of ongoing studies of two lakes. (Harris-Wisconsin) W77-06695

SOME EFFECTS ON INTEGRAL PHOTOSYNTHESIS OF ARTIFICIAL CIRCULATION OF PHYTOPLANKTON THROUGH LIGHT GRADIENTS, D. H. Jewson, and R. B. Wood. *Verhandlungen Internationale Vereinigung Limnologie*, Vol. 19, Part II, p. 1037-1044, 1975. 5 fig., 16 ref.

Descriptors: *Photosynthesis, *Laboratory tests, *Light penetration, Phytoplankton, Limnology, Foreign countries, Measurement. Identifiers: Bottle tests (Photosynthesis), *Spirulina platensis*, Lough Neagh (Northern Ireland), Lake Aranguadi (Ethiopia).

Photosynthesis studies with light and dark bottles suspended at a single depth throughout exposure time often fail to duplicate conditions found in shallow lakes in windy area where complete water column mixing prevails for long periods. To assess the effect on integral photosynthesis of cases where the phytoplankton may be circulated through a strong light gradient by this mixing, preliminary experiments were carried out on Lough Neagh, Northern Ireland and on laboratory cultures of *Spirulina platensis* (Gom.) Geitl. isolated from Lake Aranguadi in Ethiopia. The former lake has a photosynthetic zone of 1-3 m and the latter's photosynthetic zone may fall as low as 0.15 m. Light measurements in the laboratory were made using an ISCO spectroradiometer and remote probe. Changes in oxygen level were determined by the Winkler method with the end-point detected amperometrically. In the circulation experiments oxygen determinations, gross photosynthesis was obtained by adding to the oxygen increase in the circulator an amount of oxygen equivalent to that consumed in the dark bottles. Experiments in the laboratory, using *S. platensis* isolated from Lake Aranguadi, measured the effect of circulation, at speeds of 1 cm/sec and 4 cm/sec, on the photosynthetic rate. The obtained rates obtained were consistent with rates derived from stationary bottles. (Harris-Wisconsin) W77-06696

THE USE OF REMOTE SENSING TO DETECT HOW WIND INFLUENCES PLANKTONIC BLUE-GREEN ALGAL DISTRIBUTION, A. J. Horne, and R. C. Wrigley. *Verhandlungen Internationale Vereinigung Limnologie*, Vol. 19, Part II, p. 784-971, 1975. 4 fig., 13 ref.

Descriptors: *Cyanophyta, *Remote sensing, *Photometry, *Winds, Algae, Spatial distribution, Anabaena, Aerial photography, California, Pollutant identification. Identifiers: *Clear Lake (Calif.), *Multispectral scanning, Aphanizomenon.

Biological and physical aspects of cyanophyta movements in relation to prevailing winds over a summer in Clear Lake, California were measured in aerial pictures taken with a multispectral camera with four 100 m F. L. lenses and Kodak Type 2424 film. Images were recorded simultaneously in the near-infrared (730-900 nm), red (590-690 nm), green (470-590 nm) and blue (400-470 nm) bands. Winds were measured using a recording anemometer standing some 50 m above the lake surface on a peninsula adjacent to all three arms of the lake. Water samples for phytoplankton and turbidity

measurement were collected by simple dip in the upper few centimeters of lake water. Chlorophyll-a was measured using 90% methanol extraction. Results of the study showed that the role of the wind dominates in the production of blue-green algal concentration patterns and together with high light intensities, provides a possible explanation for the seasonally bimodal blooms of Aphanizomenon and Anabaena. Very light nocturnal winds permit surface films which are killed by high sunlight in summer. In the lower light of autumn these films can be windblown to areas of higher photic zone nutrient concentrations. (Harris-Wisconsin) W77-06697

REGULATING ACTIVITIES WITH CATASTROPHIC ENVIRONMENTAL EFFECTS, California Univ., Riverside. Dept. of Economics. For primary bibliographic entry see Field 6G. W77-06703

THE HISTORIC AND PRESENT RELATIONSHIPS BETWEEN PHYTOPLANKTON, LIMITING NUTRIENTS, AND SEDIMENT-WATER GEOCHEMICAL PROCESSES IN SELECTED MAINE LAKES, Maine Univ. at Orono. Land and Water Resources Inst. R. B. Davis, and S. A. Norton. Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 024. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, December 1976. 164 p. OWRT A-026-ME(3).

Descriptors: Diatoms, Diffusion, Interstices, Lakes, *Maine, Paleolimnology, Pollen, Sedimentation rates, *Sediment-water interfaces, Watersheds (Basins), Organic matter, *Trophic level, Systematics, Nutrients, *Nutrient requirements, History. Identifiers: Chronology, Cultural disturbance, Environmental tolerances, Historical records, Sediment chemistry, Sediment cores, Vertical variations.

A paleolimnological study was undertaken for a group of Maine lakes in an attempt to demonstrate the historical influence of man on lake trophic conditions. Pollen analyses, in combination with historical records for each lake watershed, were used to determine chronology and sedimentation rates within the sediment cores. Diatom analyses revealed that major shifts in the relative abundance of specific diatom taxa have occurred in several lakes over the past 200 years. However, detailed interpretation of these shifts is frustrated by the lack of knowledge of present-day environmental tolerances of the taxa. Vertical variations in sediment chemistry also correlate with the onset of European man's activity within the watershed, but behavior of individual elements seems to be unique for each lake. K2O was the most consistent indicator of cultural disturbance; CaO was the least. Also, organic content of pre-cultural sediments was generally lower than that of cultural sediments. Interstitial water chemistry profiles indicated that sediment-water interfaces were enriched in Fe, Mn, P, and Si because of upward diffusion of the dissolved species. General levels of K, Na, Ca, Mg, and Si in the interstitial waters were not directly related to bulk chemistry of the solid sediment. (Hutchins-Maine) W77-06741

AMMONIA CONCENTRATION IN RELATION TO AMMONIA TOXICITY DURING A RAINBOW TROUT REARING EXPERIMENT IN A CLOSED FRESHWATER-SEAWATER SYSTEM, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab. B. L. Hampson. *Aquaculture*, Vol. 9, p. 61-70, 1976. 1 fig, 2 tab, 13 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Salmonids, *Rainbow trout, *Nitrogen compounds, *Ammonia, *Fish hatcheries, Fish physiology, Laboratory tests, Water chemistry, Toxicity, Hydrogen ion concentration, Aquaculture, Monitoring.
Identifiers: Un-ionized ammonia, *Ammonia toxicity.

The daily monitoring of total ammonia, un-ionized ammonia, pH and temperature during a 10-month rainbow trout rearing experiment in fresh and sea water, in which fingerlings were brought up to market size in a closed circuit system, is described. The results show that high feeding, high stock intensity conditions which favour rapid growth and economic rearing, are also conditions which produce extremely low concentrations of un-ionized ammonia, and hence complete safety in respect of the ammonia toxicity hazard. Un-ionized ammonia concentration was consistently between 0.0001 and 0.1 ppm nitrogen, i.e. between 1/3000 and 1/3 of the toxic threshold. After the establishment of populations of ammonia bacteria in the sand filters, un-ionized ammonia concentrations were normally below 0.002 ppm nitrogen in fresh water and 0.0005 ppm in sea water, i.e. less than 1/150 and 1/500 of the toxic threshold. (Katz) W77-06743

FISH DISEASES AND PARASITES IN RELATION TO THE ENVIRONMENT,
Fish Farming Experimental Station, Stuttgart, Ark.
G. L. Hoffman.
Fish Pathology, Vol 10, No 2, p 123-126, 1976. 1 tab, 23 ref.

Descriptors: *Fish diseases, *Environmental effects, *Pathogenic fungi, *Water temperature, *Oxygen requirements, *Fish physiology, Fish parasites, Nutrition requirements, Water chemistry, Eutrophication, Epizootiology, Pathogenic bacteria viruses, Protozoa.
Identifiers: Environmental conditions, Neoplasias, Helminths.

Although some diseases are not affected by subtle environmental changes, others are. Factors which may influence infection or the course of disease are: temperature, gaseous supersaturation, oxygen deficiency, mechanical and physiological trauma of the fish, malappropriate water chemistry, pollution, eutrophication, media for spore retention, and presence of intermediate hosts. Avitaminoses and neoplasias are often related to environmental changes. (Katz) W77-06744

CHANGES IN THE BLOOD CHEMISTRY OF COHO SALMON EXPOSED TO MALACHITE GREEN,
Fish and Wildlife Service, La Crosse, Wis. Fish Control Lab.
T. D. Bills, and J. B. Hunn.
The Progressive Fish-Culturist, Vol. 38, No. 4, p. 214-216, 1976.

Descriptors: *Salmon, *Fish physiology, *Fungicides, Salmonids, Chemical analysis, Bioassay, Fish parasites, Fish hatcheries, Toxicity, Biochemistry.
Identifiers: Blood samples, *Malachite green, Starvation, *Hematology, *Histology, Leukopenia, *Coho salmon.

Two groups of Coho salmon, one group fed and one starved, were exposed to a sublethal concentration (0.1 mg/l) of malachite green for up to 28 days to determine the fungicide's effect on blood chemistry, hematology and histopathology. The study found no discernible differences except an increase in plasma potassium and fewer macrophages in the spleen and kidney of the treated fish. (Katz) W77-06746

FIELD TESTS OF ISOBORNYL THIOCYANOACETATE (THANITE) FOR LIVE COLLECTION OF FISHES,
Fish and Wildlife Service, Warm Springs, Ga. Southeastern Fish Control Lab.
R. M. Burress, P. A. Gilderhus, and K. B. Cumming.
Investigations in Fish Control, United States Department of the Interior, Washington, D.C. No. 71, 1976. 13 p, 11 tab, 18 ref.

Descriptors: *Sampling, Fish, *Catfish, *Carp, *Insecticides, *Fish behavior, Fish harvest, *Mortality, *Bass, *Ponds, Freshwater fish, Methodology, Pest control, Chemicals, Fish management, Fish control agents, Agriculture.
Identifiers: *Isobornyl thiocyanacetate, *Thanite, Live-collecting(Fish), Sedatives, *Lepomis ssp.

Eight ponds containing a total of 28 species of fish were treated with isobornyl thiocyanacetate (Thanite) to test its efficacy for the live collection of fish. Twenty-six species were collected alive after 1 to 4 microliters per liter applications of Thanite. Most scalefishes except carp (*Cyprinus carpio*) were relatively easy to collect, and catfishes (*Ictaluridae*) were generally the most resistant to effects of the chemical. With the exception of northern pike (*Esox lucius*), most fish recovered quickly after being placed in fresh water. Most fish collected within 1.5 h after treatment survived, but survival rates decreased with time of exposure. The concentrations effective for collection of live fish did not routinely eliminate all fish; small numbers of at least eight species of fish survived treatments of 1.5 microliters per liter or more. The high percentages of fish (of most species) collected alive demonstrated that Thanite is effective for the intended purpose. (Katz) W77-06747

TOXICITY OF ROTENONE TO FISH IN STANDARDIZED LABORATORY TESTS,
Fish and Wildlife Service, La Crosse, Wis. Fish Control Lab.
L. L. Marking, and T. D. Bills.
Investigations in Fish Control, United States Department of the Interior, Washington, D.C. No. 72, 1976. 11 p, 11 tab, 1 fig, 26 ref.

Descriptors: *Toxicants, *Toxicity, *Fish eggs, *Atlantic salmon, *Bioassay, *Mortality, *Rotenone, *Pesticides, *Laboratory tests, *Rainbow trout, *Resistance, Water temperature, Hydrogen ion concentration, Fish control agents, Salmonids, Pesticide residues, Persistence, Channel catfish.
Identifiers: *Noxfish, *Carassius auratus.

Noxfish, which contains 5% rotenone, was toxic to a variety of freshwater fish at concentrations ranging from 21.5 to 497 micrograms per liter in 96-h laboratory exposures. Goldfish (*Carassius auratus*) and black bullheads (*Ictalurus melas*) were the most resistant species and the Atlantic salmon (*Salmo salar*) was the most sensitive. Toxicity was influenced little by temperature of 7 to 22 C, by water hardness of 10 to 300 mg/l, or by pH's of 6.5 to 9.5. In exposures of rainbow trout (*Salmo gairdneri*), newly fertilized eggs were much more resistant than fingerlings. Noxfish detoxified in water solutions: the half-life of biological activity was 22 days at 12 C and 13 days at 17 C. Potassium permanganate was an excellent detoxifier; chlorine was less efficient. Noxfish was consistently more toxic in static tests than in flow-through tests. (Katz) W77-06748

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN I. QUANTITATIVE RELATIONS AND QUALITATIVE

COMPOSITION OF THE BOTTOM FAUNA OF THE KONIN LAKES COMPLEX, (IN POLISH),
Instytut Rybactwa Środlądowego, Olsztyn-Kortowo (Poland), Zakład Hydrobiologii.
L. Leszczynski.
In: Roczniki Nauk Rolniczych, Seria H, Rybactwo Vol 97(3), p. 7-27, 1976. 5 tab, 6 figs, 12 ref.

Descriptors: *Water pollution effects, *Thermal pollution, Water temperature, Diptera, *Benthic fauna, Littoral, On-site data collections, Bottom sampling, *Biological communities, Aquatic organisms, Larvae, *Biomass, Lakes.
Identifiers: Morphometry, *Poland(Konin area lakes).

Investigations were conducted on the bottom fauna of the littoral and mid-lake area during the period 1965-1969 in a complex of lakes with an artificially created horizontal thermic gradient. Heating of the water caused a drop in numbers and of the biomass, a change in the qualitative composition of the bottom fauna, and especially development of preying forms. Average length of Chironomidae was also lower. (See also W77-06750 and W77-06751) (Katz) W77-06749

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN II. CHANGES IN TIME OF BOTTOM FAUNA, (IN POLISH),
Instytut Rybactwa Środlądowego, Olsztyn-Kortowo (Poland), Zakład Hydrobiologii.
L. Leszczynski.
In: Roczniki Nauk Rolniczych, Seria H, Rybactwo Vol 97(3), p. 29-47, 1976. 3 tab, 8 fig, 2 ref.

Descriptors: *Water pollution effects, *Thermal pollution, *Water temperature, *Benthic fauna, On-site data collections, *Biological communities, Seasonal, Productivity, Diptera, *Oligochaeta, Littoral, Lakes, Diptera.
Identifiers: Seasonal fluctuations, Morphometry, Poland(Konin area lakes).

During the investigations on bottom fauna conducted during the period 1965-1969 on a complex of lakes with an artificially created horizontal thermal gradient, no influence was noted of heating the environment on the seasonal changeability scheme of the fauna. This influence did occur, however, in the transition of seasonal phenomena in time. Changes in the bottom fauna during successive years of the study showed a lack of influence of heating the environment on the range of relative fluctuations in the level of average numbers, but was evident in fluctuations of the size of individuals, qualitative composition, and rate of domination resulting from changed thermal conditions. (See also W77-06749 and W77-06751) (Katz) W77-06750

THE INFLUENCE OF EFFLUENT HEATED WATERS ON THE BOTTOM FAUNA OF LAKES IN THE VICINITY OF KONIN III. AN EFFORT TO EXPLAIN THE CAUSES AND RESULTS OF CHANGES IN THE BOTTOM FAUNA OF LAKES AS INFLUENCED BY THE INFLOW OF HEATED WATERS, (IN POLISH),
Instytut Rybactwa Środlądowego, Olsztyn-Kortowo (Poland), Zakład Hydrobiologii.
L. Leszczynski.
In: Roczniki Nauk Rolniczych, Seria H, Rybactwo Vol 97(3), p. 49-68, 1976. 63 ref.

Descriptors: *Water pollution effects, *Thermal pollution, Water temperature, *Benthic fauna, Biological communities, Epilimnion, Seasonal, Mixing, *Diptera, *Oligochaeta, Lakes.
Identifiers: Annual fluctuations, Chaoborus, Accelerated development, Mobility, Tanyptodinae, Ceratopogonidae, Polyceniopinae, Morphometry, *Poland(Konin area lakes).

Results obtained on an investigation of bottom fauna conducted on lakes with an artificially created horizontal thermic gradient were compared with data contained in literature. The obtained indices for changes resulting in the water environment as a result of increasing the temperature were verified on the basis of literature, and consideration also given to the causes (primary and secondary) and effects of changes in the bottom fauna. (See also W77-06749 and W77-06750) (Katz)
W77-06751

PRIMARY AND SECONDARY PRODUCTION OF PLANKTON IN HEATED LAKES, (IN POLISH),

Polish Academy of Sciences, Warsaw. Inst. of Ecology; and Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.
A. Hillbricht-Ilkowska, B. Zdanowski, J. Ejsmont-Karabinowa, A. Karabin, and T. Weglenska.
In: *Roczniki Nauk Rolniczych*, Seria H, Rybactwo Vol 97(3), p. 69-88, 1976. 6 tab, 2 fig, 28 ref.

Descriptors: *Primary productivity, *Secondary productivity, Phytoplankton, *Zooplankton, *Water pollution effects, *Thermal pollution, Water temperature, Biological communities, Crustaceans, Eutrophication, Flow, On-site data collection, Lakes.
Identifiers: Summer stagnation, Water transparency, Predatory zooplankton, Non-predatory zooplankton, Ecological output index, Morphometry, Poland.

Measurements of phyto- and zooplankton production were carried out during the peak of summer stagnation in 1973 on three lakes heated by a thermal power plant. Results were compared with those obtained in 1966. Raising the water temperature around 4°C resulted in an increase of primary production, high growth of numbers, biomass and production of non-preying zooplankton, as also in an increase in the effectiveness of the non-preying link. Increasing the time of water flushing rate in the basin (to around 3.5 days) led to a drop in primary production, and to an increase in non-preying zooplankton production and growth of ecological effectiveness in the non-preying link. As concerns the preying link, a drop in production and ecological effectiveness was noted. (Katz)
W77-06752

THE INFLUENCE OF HEATED EFFLUENT WATERS ON THE WATER CHEMISTRY OF KONIN LAKES, (IN POLISH),

Instytut Rybactwa Środoladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
A. Korycka, and B. Zdanowski.
In: *Roczniki Nauk Rolniczych*, Seria H, Rybactwo Vol 97(3), p. 89-107, 1976. 5 tab, 4 fig, 31 ref.

Descriptors: *Water pollution effects, *Thermal pollution, *Water temperature, *Electric power production, Water chemistry, Chemical analysis, *Electrolytes, *Conductivity, Phosphates, Nitrogen, Flow augmentation, Mine drainage, Industrial wastes, Lakes.
Identifiers: Mineral salts, Morphometry, *Poland (Konin area lakes).

the study deals with the evaluation of changes in the water chemistry of lakes, heated by effluent heated waters from an electric power plant, and differentiated from a morphometric and trophic point of view. The studies were conducted over the period 1965-1974. A constant increase in the content of some mineral salts in the lakes was noted, as also in electrolytic conductivity. These changes were linked to the industrialization of the drainage basin of the lakes under study. (Katz)
W77-06753

OCCURRENCE AND GROWTH OF DREISSENA POLYMORPHA PALL. IN LAKES INCLUDED IN A COOLING SYSTEM, (IN POLISH),

Polish Academy of Sciences, Warsaw. Inst. of Ecology; and Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.
A. Stanczykowska.

In: *Roczniki Nauk Rolniczych*, Seria H, Rybactwo Vol 97(3), p. 109-122, 1976. 2 tab, 9 fig, 15 ref.

Descriptors: *Mollusks, *Larvae, *Growth rates, Zooplankton, Destraification, Water pollution effects, *Thermal pollution, *Water temperature, On-site data collections, Thermal stratification, Lakes.

Identifiers: *Age classes, *Life span, *Oxygen stratification, Shell size, Shell weights, *Poland (Konin area lakes).

Similar numbers of *Dreissena polymorpha* were noted in the five lakes of the Konin lakes complex, characterized by various water temperatures. However, the period of occurrence of larvae in the plankton is longer, and growth of adult individuals more rapid, in heated than in cool lakes. Snails from the warmer lakes grow more rapidly. Size and weight of *Dreissena* from the Konin lakes complex were less than those in the lakes of the Mazurian lakes complex. Life span in the most highly heated canal was shorter by one year than those in the other lakes of the Konin lakes complex. (Katz)
W77-06754

LONG-TERM CHANGES OF THE PELAGIC PRIMARY PRODUCTION IN HEATED LAKES, (IN POLISH),

Instytut Rybactwa Środoladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
B. Zdanowski.

In: *Roczniki Nauk Rolniczych*, Seria H, Rybactwo Vol 97(3), p. 123-139, 1976. 3 tab, 3 fig, 38 ref.

Descriptors: *Primary production, *Phytoplankton, Water pollution effects, *Thermal pollution, *Water temperature, *Electric power production, *Eutrophication, Mesotrophy, Flow augmentation, Cycling nutrients, On-site data collections, Lakes, Measurement.
Identifiers: *Poland.

Measurements of the primary production of phytoplankton were carried out during the period 1967-1973, in the pelagic waters of two lakes heated by thermal effluents discharged by an electric power plant. Heating of waters resulted in an increased primary production (by about 50%), changes of its vertical distribution, and changes in the share of respiration in gross primary production. Decrease of the detention time in the lake (exchange of the total volume of water in lakes 3.5 days) restricted the intensity of production. (Katz)
W77-06755

THE INFLUENCE OF HEATED EFFLUENT WATERS ON THE THERMAL-OXYGEN RELATIONS AND WATER TRANSPARENCY IN THE KONIN LAKES COMPLEX, (IN POLISH),

Instytut Rybactwa Środoladowego, Olsztyn-Kortowo (Poland). Zakład Hydrobiologii.
B. Zdanowski, and A. Korycka.
In: *Roczniki Nauk Rolniczych*, Seria H, Rybactwo Vol 97(3), p. 141-164, 1976. 2 tab, 12 fig, 21 ref.

Descriptors: *Water pollution effects, *Thermal pollution, *Water temperature, *Electric power production, *Cooling water, Epilimnion, Stratification, Thermal stratification, Oxygen, Seasonal, Primary productivity, Lakes.
Identifiers: Morphometry, Water transparency, Summer stagnation, Reverse stratification, Surface inflow, Cascade inflow, Oxygen stratification, *Poland (Konin area lakes).

Results of seasonal observations on thermal-oxygen relations and water transparency of five lakes heated by an electric power plant are given. Heating of three lakes (1965-1969) resulted in considerable thermal variability between them, which decreased following inclusion of the whole lake complex in the cooling system of the power plant (1970-1973). Apart from the influence of the absolute amounts of heated effluents and air temperature, morphometric factors were decisive for the temperature level of the lakes, such as their maximal and average depths, and their surface. The influence of high temperature in shallow lakes was noted throughout the volume of the water body, while in deep ones only the epilimnion layers were affected. (Katz)
W77-06756

ADSORPTION OF POLYCHLORINATED BIPHENYL (AROCOR 1254) ON SHRIMP, Louisiana State Univ., Baton Rouge. Dept. of Food Science.

M. A. Khan, R. M. Rao, and A. F. Novak.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 4, p. 503-504, 1976. 1 tab, 2 ref.

Descriptors: *Crustaceans, *Shrimp, *Shellfish, *Path of pollutants, *Adsorption, *Aroclor, *Polychlorinated biphenyls, Food chains, Pesticides, Chlorinated hydrocarbon pesticides.

Peeled, deheaded and deveined shrimp and unpeeled shrimp were dipcoated in 100 ppm solution of Aroclor 1254 for one minute. Values of adsorbed PCB averaged 33.2 and 26.3 micrograms per 100 grams solids for unpeeled and peeled shrimp, respectively, showing a significant statistical difference. This indicates a possible site of PCB accumulation, especially in shrimp and possibly in other marine animals with outer shells. It also suggests a careful utilization of shrimp waste as feed for fish or other animals. (Katz)
W77-06758

INDUCTION OF HEPATIC MICROSOMAL ENZYMES BY AROCLOR 1254 IN ICTALURUS PUNCTATUS (CHANNEL CATFISH),

Texas A and M Univ., College Station. Dept. of Veterinary Physiology and Pharmacology.
D. W. Hill, E. Hejtmancik, and B. J. Camp.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 4, p. 495-502, 1976. 2 tab, 16 ref.

Descriptors: *Respiration, *Bioassay, *Absorption, *Aroclor, *Polychlorinated biphenyls, *Channel catfish, *Cytological studies, *Metabolism, *Enzymes, *Pesticides, *Fish physiology, Chlorinated hydrocarbon pesticides, Freshwater fish, Water pollution effects.
Identifiers: *Mitochondria, *Sublethal effects.

Aroclor 1254, a polychlorinated biphenyl, concentrates in the liver and brain of channel catfish, with signs of liver disfunction. After exposure to 2 ppm Aroclor 1254 for 24 hours and 48 hours, examination of test fish showed maximum concentration of PCBs was obtained in all tissues after 12 hours. The level of PCB was maintained for 480 hours with no apparent change in tissue distribution. The effect of Aroclor 1254 on hepatic microsomal enzyme activity and mitochondrial respiration was tested after exposure of test fish to 1 ppm Aroclor 1254 for 96 hours. Both aminopyrine N-demethylase and aniline hydroxylase activities were significantly increased over the control fish by 68.4% and 47.5% respectively. No inhibition of mitochondrial respiration was observed. It must be concluded that Aroclor 1254 at moderate concentrations does not affect electron transport or oxidative phosphorylation in liver mitochondria and therefore, does not interfere with the aerobic synthesis of ATP. (Katz)
W77-06759

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

NOTES ON THE NESTING SUCCESS AND FECUNDITY OF THE ANEMONEFISH AMPHIPRION CLARKII AT MIYAKE-JIMA, JAPAN,
Tatsuo Tanaka Memorial Biological Station, Tokyo (Japan).
L. J. Bell.

Japanese Journal of Ichthyology, Vol. 22, No. 4, p 207-211, March 1976. 1 fig, 1 tab, 8 ref.

Descriptors: *Reproduction, Biological properties, *Fecundity, Spawning, Incubation, Hatching, Fish, Asia, Water pollution effects, Islands.
Identifiers: *Anemonefish, *Japan(Miyake-jima).

At Miyake-jima, *Amphiprion clarkii* spawns from May to September with a nesting frequency of 6-8 times/year. The incubation period varied from 6 1/2 days to 12 1/2 days. In the seven 6 1/2 day examples, temperatures ranged from 26.5-27.5°C. The 12 1/2 day period was in the midst of a long period of cold water which varied from 19-23°C for the first ten days of incubation, then rose abruptly to 26°C, after which the eggs quickly developed and hatched. Egg counts resulted in an estimated fecundity of approximately 1,100-2,500 eggs per spawning. 94.8% of nests under observation were successful. (Chilton-ORNL)
W77-06763

THE MEASUREMENT OF TEMPERATURE TOLERANCE: VERIFICATION OF AN INDEX,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.

B. P. Bradley.
Limnology and Oceanography, Vol. 21, No. 4, July 1976, p 596-599, 2 tab, 7 ref.

Descriptors: *Environmental effects, *Temperature, Resistance, Measurement, Forecasting, Copepods, *Pollutant identification, *Bioassay, *Bioindicators, Water pollution effects.
Identifiers: Shock-recovery assay, *Eurytemora affinis*.

A shock-recovery assay for temperature tolerance is demonstrated to predict survival of *Eurytemora affinis* at high temperatures. It is possible to modify the assay to allow comparisons between widely divergent treatment groups. Time to succumb (TS) and time to recover (TR) were observed over a 30-min period at a temperature of 34.5°C (about 15°C above the temperature at which the animals were raised and about 5°C higher than any temperature normally encountered). The index of temperature tolerance was 30 plus TS minus TR, since time to succumb was positively related and time to recover was negatively related to temperature tolerance. The repeatability of the index was measured by testing animals and then retesting after a 1-h period at room temperature. The correlation between index values on the same animal was a measure of the reliability of the index. (Chilton-ORNL)
W77-06764

ENVIRONMENTAL FACTORS AFFECTING SURVIVAL AND GROWTH OF VIBRIO PARAHAEOLYTICUS. A REVIEW,
Georgia Univ., Experiment. Div. of Food Science.
L. R. Beuchat.
Journal of Milk Food Technology, Vol. 38, No. 8, August 1975, p 476-480, 48 ref.

Descriptors: *Environmental effects, *Mortality, *Animal growth, Temperature, Salinity, Hydrogen ion concentration, Dehydration, Drying, Resistance, Water pollution effects.
Identifiers: **Vibrio parahaemolyticus*.

The response of *V. parahaemolyticus* was found to be dependent upon interactions between chemical and physical forces. The organism is sensitive to both heat and cold, generally displaying more resistance to freezing than chilling. Its resistance to

potentially lethal extremes in temperature is greatly affected by the chemical makeup of the medium in which the organism is treated. It is sensitive to desiccation and grows best in a medium containing about 3% sodium chloride. It prefers an alkaline pH for growth, but is most resistant to heat at pH 7.0. (Chilton-ORNL)
W77-06765

GROWTH AND MOVEMENT OF FISH IN THE VICINITY OF A THERMAL DISCHARGE,
Aquinas Coll., Grand Rapids, Mich.

R. S. Benda.
Indiana Academy of Science Proceedings, Vol. 83, 1974, p 185-191, 5 tab, 19 ref.

Descriptors: *Environmental effects, *Thermal pollution, Water pollution, Thermal stress, Powerplants, Discharge(Water), Fish, Movement, Growth rates, *Indiana, Rivers.

During the two year study, average temperature elevation ranged from less than 1°F the first year to 3°F the second year. During normal plant output (2 units operating) a temperature change of 20°F with a rate flow of 675 cubic feet/second was found. Maximum discharge temperatures reached over 100°F and cooled gradually downstream. Data indicated that a majority of the centrarchids remained in the same areas as originally found and moved away from rather than towards the heated water. No significant difference were observed in the growth rates of longear sunfish, green sunfish, bluegill, spotted bass, white crappie, and black crappie from separate areas. A comparison of the growth rates of these species with the same species in other areas in the midwest showed that the White River specimens fit within the range of established growth rates for the region. (Chilton-ORNL)
W77-06766

TEMPERATURE RELATIONS OF PUGET SOUND THAIDS IN REFERENCE TO THEIR INTERTIDAL DISTRIBUTION,

Western Washington State Coll., Bellingham. Dept. of Biology.
M. D. Bertness, and D. E. Schneider.
The Veliger, Vol. 19, No. 1, July 1976, p 47-58, 9 fig, 2 tab, 33 ref.

Descriptors: *Environmental effects, *Distribution patterns, Temperature, *Snails, Intertidal areas, *Washington.
Identifiers: *Thais lamellosa*, *Thais emarginata*, Puget Sound(Wash).

Populations of *Thais lamellosa* and *Th. emarginata* were found to exhibit intraspecific shore-level size gradient patterns which place the smaller individuals at the top of each species vertical range. The *Th. emarginata* population was found higher in the intertidal zone than the *Th. lamellosa* population. The lethal thermal limits of the 2 thaids revealed inter- and intraspecific differences in their tolerance with the *Th. emarginata* showing the greatest thermal resistance. Within the *Th. lamellosa* size classes the small snails had the highest thermal limits. Humidity was an important factor in the thermal limits. Respiratory response to temperature increase indicated that the *Th. emarginata* and the small size class within each species displayed the most pronounced temperature independence. It was concluded that the adaptations of both species to thermal stress which were shown in this paper probably do not play a major role in directly creating the observed distributional patterns. (Chilton-ORNL)
W77-06767

SEASONAL CHANGES IN THE RESPIRATION OF PUMPKINSEED, LEPOMIS GIBBOSUS, CORRELATED WITH TEMPERATURE, DAY LENGTH, AND STAGE OF REPRODUCTIVE DEVELOPMENT,
Massachusetts Univ., Amherst. Dept. of Zoology.

J. R. Burns.
Physiological Zoology, Vol. 48, No. 2, April 1975, p 142-149, 2 tab, 3 fig, 21 ref.

Descriptors: *Environmental effects, *Seasonal, *Temperature, Photoperiodism, Reproduction, *Respiration, Fish, Physiology.
Identifiers: *Lepomis gibbosus*, *Pumpkinseed.

Seasonal changes in the respiratory rate of pumpkinseed, *Lepomis gibbosus*, measured at environmental temperature and photoperiod indicated that temperature, day length and reproductive state affected respiration. Temperature coefficients were calculated for the changes in respiration of adjacent months. Higher coefficients were observed at lower temperatures. A zone of relative temperature independence of the respiratory rate was observed between 14.2 and 19.7°C, minimally. During the reproductive season, respiration remained high in contrast to the expected effect of long day lengths, suggesting an influence of reproductive hormones on the respiratory rate. An effect of photoperiod was seen only for a short interval following spawning. Seasonal acute respiration at 17.5°C was measured and showed inverse relationship between acclimatization temperature and respiratory rate except at the onset of the reproductive season when the respiration increased sharply. (Chilton-ORNL)
W77-06768

EFFECT OF TWO REARING CONDITIONS ON GROWTH AND BODY COMPOSITION IN CARP (CYPRINUS CARPIO L), (INFLUENCE DE DEUX MODES D'ELEVAGE SUR LA CROISSANCE ET LA COMPOSITION CORPORELLE DE LA CARPE COMMUNE),
Toulouse-3 Univ. (France). Laboratoire d'Ecophysiologie des Animaux.
G. Bouche, J. P. Parent, and A. Serfaty.
Journal of Physiology, Paris, Vol. 70, 1975, p 659-668, 3 tab, 1 fig, 12 ref.

Descriptors: *Environmental effects, *Metabolism, Temperature, Seasonal, *Carp, Carbohydrates, Nitrogen, Animal growth, Fish.
Identifiers: RNA, DNA.

Carp were studied in natural ponds to determine the influence of seasonal changes on nitrogen and carbohydrate metabolism. Carp receiving industrial dried foods showed no measurable growth while those in natural habitats did exhibit growth. It was concluded that rebonucleic activity and protein metabolism were correlated with seasonal variations in water temperatures. (Chilton-ORNL)
W77-06769

THE ALGAL FLORA IN THE THERMAL BATHS OF MONTEGROTTO TERME (PADUA). ITS DISTRIBUTION OVER ONE-YEAR PERIOD,

Padova Univ. (Italy). Istituto di Botanica e Fisiologia Vegetale.
C. Andreoli, and N. Rascio.
Int. Revue ges. Hydrobiol. Vol. 60, No. 6, 1975, p 857-871, 1 tab, 2 fig, 28 ref.

Descriptors: *Environmental effects, *Temperature, *Thermal springs, *Algae, Distribution, Seasonal.
Identifiers: *Italy(Padua).

The algal microflora of a thermal spring and of thermal baths were studied to ascertain the existence of a seasonal succession, on the base of number and frequency qualitatively evaluated, of algal species. The pH and temperature of waters and muds as well as algae samples were collected from seven stations monthly. The thermal spring temperatures ranged from 65-75°C. Temperatures of the mud cisterns varied (euthermal 40-60°C, hypothermal 13-18°C, hyalothermal 18-30°C, euriothermal 30-50°C, and acrothermal over 50°C). Three Cyanophyceae species were quantitatively

more abundant the 64 species of Diatomeae. Among the most frequent species were found *Melosira sol.*, *M. granulata*, *Cocconeis placentula*, *Nitzschia denticula*, *Denticula elegans* and *D. tenuis*. Other species were found irregularly. (Chilton-ORNL)
W77-06770

HEAT RESISTANCE OF GAMETES OF MARINE INVERTEBRATES IN RELATION TO TEMPERATURE CONDITIONS UNDER WHICH THE SPECIES EXIST.
Akademiya Nauk SSSR, Leningrad. Lab. of Comparative Cytology.
V. B. Andronikov.
Marine Biology, Vol. 30, 1975, p 1-11, 1 tab, 6 fig, 51 ref.

Descriptors: *Environmental effects, *Distribution patterns, Reproduction, Resistance, Heat resistance, Spawning, *Invertebrates, Marine animals, Temperature.
Identifiers: *Poikilotherms, Gametes.

A review is presented of known data on the heat resistance of gametes of marine invertebrates as well as presenting some new data. The heat resistance of gametes is concluded to be correlated with the degree of thermophily of the species concerned. Eggs, zygotes, and early stages of embryonic development of poikilotherms were found to be most susceptible to heat injury. The upper thermal limit for the normal development of eggs and embryos was found to be only 1-3°C higher than ambient temperatures. It was concluded that the heat resistance level of gametes and embryos represents an adjustment to temperatures at which spawning, fertilization and earlier embryonal development occur. Temperatures which exceed the upper or lower thermal limits throughout the year act as limiting factors for species distribution. (Chilton-ORNL)
W77-06771

EFFECT OF SALINITY ON SPORE GERMINATION OF TERRESTRIAL AND MARINE FUNGI.
Portsmouth Polytechnic (England) Dept. of Biological Sciences.
P. Byrne, and E. B. G. Jones.
Trans. Br. Mycol. Soc., Vol. 64, No. 3, 1975, p 497-503, 2 fig, 2 tab, 16 ref.

Descriptors: *Environmental effects, *Salinity, *Temperature, *Spores, Germination, *Fungi, Aquatic fungi, *Marine fungi, Freshwater, Terrestrial habitats, Water pollution effects.

Eleven terrestrial, freshwater, and marine fungi were investigated to determine the combined effect of salinity and temperature on spore germination. Spore germination in terrestrial fungi was found to decrease with increasing salinities with the effect being greater at low temperatures. The freshwater hyphomycete *T. setigerum* exhibited a broad tolerance to salinity at 20 and 25°C although increasing salinities caused a slight reduction. The marine fungi exhibited a wide tolerance to salinity at each temperature. It was suggested that the percentage spore germination decrease with increasing salinities for terrestrial fungi may explain why so few terrestrial fungi are found in the sea but that the effect of salinity on vegetative growth and reproduction, temperature requirements, availability of suitable substrates for colonization and spore dispersal may also be responsible factors. (Chilton-ORNL)
W77-06772

DISPERSAL AND DISPERSION OF POND SNAILS IN AN EXPERIMENTAL ENVIRONMENT VARYING TO THREE FACTORS, SINGLY AND IN COMBINATION.
Iowa Univ., Iowa City. Dept. of Zoology; and Iowa Univ., Iowa City. Lakeside Lab.
R. V. Bovbjerg.

Physiological Zoology, Vol. 48, No. 3, July 1975, p 203-215, 9 fig, 18 ref.

Descriptors: *Environmental effects, *Distribution patterns, Dispersion, *Snails, Thermal stress, Vegetation, Laboratory tests, Water pollution.
Identifiers: Carrion.

The positions of pond snails in a laboratory environment were mapped at the end of a 1 h observation period. Experiments varied in three environmental factors: presence and absence of vegetation, of animal carrion, and a thermal gradient. In the presence of single factors, the snails responded with a kinesis to an aggregation on vegetation, a negative thermotaxis from high temperature, and a strong chemotaxis toward animal carrion. In combination, vegetation tended slightly to mask the aggregations on carrion and in the cooler water. A strong synergism was evident in aggregation on carrion in cooler water. It was concluded that this simulation supported the original assumption that animals would respond to the various factors by locomotion either away from or toward the environmental factors and would form a pattern of dispersion related to that of environmental patchiness. (Chilton-ORNL)
W77-06773

HEALTH EFFECTS OF MULTIPURPOSE USE OF WATER.
Stockholm Univ. (Sweden). Wallenberg Lab.
E. Arrhenius.
Ambio, Vol. VI, No. 1, 1977, p. 59-62, 31 ref.

Descriptors: *Environmental effects, *water pollution effects, *Public health, Water pollution control, Mercury, Cadmium, Radioisotopes, Pollutants.
Identifiers: Eternal pollutants.

Different types of contaminants which constitute health risks and the countermeasures against various pollutants are discussed. The focus is on what is termed eternal pollutants which are defined as pollutants which have their toxic properties inherent in the atoms themselves and can thus not be chemically destroyed. It is concluded that the only way in which these pollutants can be temporarily eliminated is through their being shunted into non-biological isolation where they are not recirculated. It is also concluded that the ultimate goal for handling of eternal pollutants must be to avoid any release of those which have no positive biological effects and to substitute all processes involving these chemicals with alternative processes in which less harmful substances can be used. (Hilton-ORNL)
W77-06775

LONG-TERM LEAD ACCUMULATION IN ABALONE (HALIOTIS SPP.) FED ON LEAD-TREATED BROWN ALGAE (EGREGIA LAEVIGATA).
Scripps Institution of Oceanography, La Jolla, Calif.
J. Stewart, and M. Schulz-Baldes.
Marine Biology, Vol. 36, 1976, p 19-24, 2 tab, 4 fig, 18 ref.

Descriptors: *Environmental effects, Absorption, *Lead, Algae, Foods, Path of pollutants, Water pollution, *Phaeophyta.
Identifiers: *Abalone, *Haliotis rufescens*, *Egregia laevigata*.

Forty juvenile *Haliotis rufescens* were individually tagged, weighed, and apportioned into three tanks. Twenty of the abalone after 3 months and twenty after 6 months were analyzed for lead content in their total soft parts. After 3 months and twenty after 6 months were analyzed for lead content in their total soft parts. After 3 months, abalone fed on algae grown in an environment to which no lead had been added contained slightly

less lead than those fed algae grown in an environment to which 0.1 mg l(-1) PbCl₂ had been added. Specimens fed on algae grown in an environment to which 1.0 mg l(-1) PbCl₂ had been added showed distinctly greater accumulations of lead. After 6 months, abalone fed on algae pretreated with 1.0 mg Pb l(-1) accumulated up to 21 micrograms Pb g(-1) wet weight. The lead was selectively concentrated in the digestive gland with only negligible amounts being found in the muscle tissue. (Chilton-ORNL)
W77-06776

EFFECTS OF VARIOUS ECOLOGICAL FACTORS ON RADIOSTRONTIUM UPTAKE IN TWO EURYHALINE TELEOSTS: MUGIL AUSTRALIS AND PLEURONECTES PLATESSA, (INFLUENCE DE DIVERS FACTEURS ECOLOGIQUES SUR L'ACCUMULATION DU RADIOSTRONTIUM CHEZ DEUX TELEOSTEENS EURYHALINS: MUGIL AUSTRALIS ET PLEURONECTES PLATESSA L.).
CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses (France). Departement de Protection.
J. C. Amiard.
Report No. CEA-R-4706, 1975, 73 p, 27 tab, 18 fig, 130 ref.

Descriptors: *Environmental effects, *Absorption, *Radioisotopes, Strontium radioisotopes, *Teleosts, Fish, *Age, *Salinity, *Temperature, *Sediments, Foods, Calcium, Metabolism, Water pollution effects.

The effects of age, species, salinity, temperature, sediment, calcium overload, and food on the accumulation of Sr85 in two euryhaline Teleosts were investigated. The physico-chemical and biotic factors which tend to activate metabolism caused a slight increase in radiostromium intake. According to the concentration kinetics of Sr85, bone type tissues, soft tissues, and digestive tract were distinguished. In toto measurements showed concentrations seldom more than one. (Chilton-ORNL)
W77-06777

REPRODUCTIVE CYCLE OF TROUT AND TENCH: EFFECT OF EXPERIMENTAL VARIATIONS OF THE TEMPERATURE, (ETUDE SUR LE CYCLE REPRODUCTEUR DO LA TRUITE ARC-EN-CIEL ET DE LA TANCHE: EFFET DE VARIATIONS EXPERIMENTALES DE LA TEMPERATURE).
Institut National de la Recherche Agronomique, Jouy-en-Josas (France). Laboratoire de Physiologie des Poissons.
B. Breton, B. Jalabert, A. Fostier, and R. Billard.
Journal of Physiology, Paris, Vol. 70, 1975, p 561-564, 1 tab, 5 ref.

Descriptors: *Environmental effects, *Laboratory tests, Physiology, *Reproduction, *Temperature, *Trout.
Identifiers: Hormones, Gonadotropin, *Tench.

Temperature elevations of 3 and 6°C (in conditions where ycthemeral and seasonal rhythmicity were maintained) resulted in a significant increase in fertility with the increase in temperature. The first spawning period was found to be earlier and a rise in the number of spawnings was observed. This effect of temperature was said to act at the level of the hypothalamo-pituitary system. At the time of spermatogonia divisions a rise in the plasma gonadotropin levels was found. (Chilton-ORNL)
W77-06779

MEDIAN TOLERANCE LIMITS OF SOME CHEMICALS TO THE FRESH WATER FISH CYPRINUS-CARPIO.
Andhra Univ., Waltair (India). Coll. of Engineering.
T. S. Rao, M. S. Rao, and S. B. S. K. Prasad.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Indian Journal of Environmental Health, Vol. 17, No. 2, 1975, p 140-146, 3 tab, 6 ref.

Descriptors: *Environmental effects, *Water pollution effects, Water pollution sources, Heavy metals, Insecticides, Pesticides, Phenols, *Toxicity, Fish, Freshwater, Bioassay, *Carp, Chlorinated hydrocarbon pesticides, Pollutant identification.

Bioassay experiments were conducted to determine the toxicity of insecticides, pesticides, phenolic compounds, and metals. Of the phenolic compounds, pyridine was more toxic than xylene. Among the chlorinated hydrocarbon insecticides, chlordane was more toxic than aldrin and dieldrin. Among the metal salts, silver nitrate was highly toxic and ammonium chloride was the least toxic. Lead nitrate was more toxic than zinc sulphate and copper sulphate. (Chilton-ORNL) W77-06780

HEAVY METAL CONCENTRATIONS IN WATER, SEDIMENTS, AND FISH FROM MEDITERRANEAN COASTAL AREA, ISRAEL. Israel Oceanographic and Limnological Research Ltd., Haifa, Haifa Labs. I. Roth, and H. Hornung.

Environmental Science and Technology, Vol. 11, No. 3, March 1977, p 265-269, 8 tab, 44 ref.

Descriptors: *Water pollution effects, *Environmental effects, Toxicity, Absorption, Heavy metals, Water pollution sources, Water, Sediments, Fish, Coasts, Pollutant identification. Identifiers: Israel, *Mediterranean Coast (Israel).

The concentration of the heavy metals investigated (Cadmium, Lead, Copper, Zinc, Manganese, Chromium) both in water and sediments is similar to those found in literature for unpolluted regions. Analyses of the edible muscle tissue of the 12 most common commercial fish showed low concentration levels of the metals. The area where the investigations were conducted (Israel) is still relatively unpolluted and continued monitoring of the heavy metal concentrations is recommended. (Chilton-ORNL) W77-06782

CORRELATION COEFFICIENTS AND CONCENTRATION FACTORS OF COPPER AND LEAD IN SEAWATER AND BENTHIC ALGAE, RUTGERS. The State Univ., New Brunswick, N. J. Dept. of Botany. U. Seeliger, and P. Edwards.

Marine Pollution Bulletin, Vol. 8, No. 1, 1977, p 396-400, 5 fig, 24 ref.

Descriptors: *Water pollution effects, *Environmental effects, Toxicity, *Copper, *Lead, *Algae, Benthic flora, Marine algae, Correlation analysis, Bays, *New York. Identifiers: Concentration factors, *Raritan Bay (NY).

The study was conducted along the south shore of Raritan Bay adjacent to the New York metropolitan region. Correlation coefficients of 0.98 were found for copper and 0.97 for lead. These figures indicate a high degree of correspondence between levels of both metals in water and in algal tissue. The data indicate that Raritan Bay is a highly polluted coastal environment. (Chilton-ORNL) W77-06783

A PRELIMINARY SURVEY OF MERCURY IN FISH FROM BOMBAY AND THANA ENVIRONMENT. Institute of Science, Bombay (India). Inorganic and Nuclear Chemistry Lab. B. M. Tejam, and B. C. Haldar.

Indian Journal of Environmental Health, Vol. 17, No. 1, 1975, p 9-16, 4 tab, 3 ref.

Descriptors: *Environmental effects, *Water pollution effects, Heavy metals, *Mercury, Fish, Absorption, Asia, Pollutant identification. Identifiers: India, Bombay, Thana (India), Neutron activation analysis.

A survey for mercury in thirty species from 7 locations in Bombay and Thana was conducted. Neutron activation techniques were used to analyze for mercury in muscle, bone and brain in fish samples. Concentrations were greater in brain than muscle and greater in muscle than in bone. Harpodon nehereaus showed the lowest concentration while Hilsa ilisha showed the highest concentration. Bones and muscle of Tilapia mozambique, Mugil dussumieri and some other varieties showed concentrations greater than 500 ng/g on fresh weight basis. (Chilton-ORNL) W77-06785

LABORATORY STUDIES ON THE EFFECT OF METALS ON OXYGEN UPTAKE BY SEWAGE SLUDGE IN BRACKISH WATER. Bristol Univ. (England). Dept. of Bacteriology. A. J. Sylvester, and G. C. Ware.

Marine Pollution Bulletin, Vol. 8, No. 2, February 1977, p 45-48, 4 fig, 1 tab 9 ref.

Descriptors: *Environmental effects, *Laboratory tests, Heavy metals, *Sewage sludge, Water pollution effects, Water pollution sources, Industrial wastes, Cadmium, Zinc, Lead, Oxygen, Oxygenation, Respiration, *Metals, Brackish water.

All experiments showed an initial high rate of oxygen consumption by freshly diluted sewage sludge which was unaffected by the presence of 500 microg/mg streptomycin sulphate. The rate fell rapidly during the first few hours after dilution. In the absence of streptomycin the oxygen consumption rate recovered to a greater or lesser extent depending upon the concentration and type of metal ions present. When streptomycin was present no recovery in the rate of oxygen uptake was observed. After 12 h contact with the diluting water the rate of oxygen uptake of the sludge in the mixture containing 10 microg/l of cadmium was similar to the control. After this time and until completion of the experiment, the rate of oxygen uptake steadily increased. Similar results were obtained with lead. A stimulatory effect was observed in lead concentrations of 200 microg/l. At concentrations of 500 microg/l, zinc had a stimulating effect after 48 h contact. (Chilton-ORNL) W77-06788

RESPIRATORY RESPONSE OF CUNNERS TO SILVER.

National Marine Fisheries Service, Milford, Conn. Middle Atlantic Coastal Fisheries Center. F. P. Thurberg, and R. S. Collier.

Marine Pollution Bulletin, Vol. 8, No. 2, February 1977, p 40-41, 1 tab, 11 ref.

Descriptors: *Environmental effects, *Respiration, Heavy metals, Mercury, Cadmium, Fish, Water pollution effects. Identifiers: *Cunners, *Silver.

After exposure to concentrations of 0.12, 0.25 and 0.50 ppm silver nitrate for 96 h, gill-tissue oxygen consumption measurements were made. Exposures to concentrations as low as 0.12 ppm resulted in significant respiratory depression. Depressed gill-tissue oxygen consumption rates were also found in cunners exposed to 50 and 100 ppb cadmium for periods of up to 60 days. Winter flounder and striped bass also show cadmium-induced depression of oxygen consumption but exposure to mercury resulted in elevated gill-tissue respiration rates. It was concluded that different metals have different effects on physiological stress indicators. (Chilton-ORNL) W77-06789

HEAVY METALS IN MACROINVERTEBRATES AND FISH FROM THE LOWER MEDWAY ESTUARY, KENT. Sir John Cass Coll., London (England). School of Sciences and Technology.

J. R. Wharfe, and W. L. F. Van Den Broek.

Marine Pollution Bulletin, Vol. 8, No. 2, February 1977, p 31-34, 1 fig, 2 tab, 10 ref.

Descriptors: *Environmental effects, *Heavy metals, Absorption, Fish, Invertebrates, Mercury, Copper, Zinc, Lead, Cadmium, Estuaries, Fish diets, Water pollution effects. Identifiers: *Medway estuary (Eng).

Macroinvertebrates and fish were analyzed for mercury, zinc, copper, lead, and cadmium periodically from April 1973-January 1976. Levels of metals in animals from the lower Medway estuary were low, although higher values of lead and cadmium were found in the vicinity of industrialized areas. Information on fish diets and the levels found in invertebrates showed little evidence of any accumulation, although it was noted that smaller size class of prey taken were not analyzed. Sediment and water samples were not analyzed. (Chilton-ORNL) W77-06790

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 1: MARINE MAMMALS, MARINE BIRDS.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

For primary bibliographic entry see Field 6G.

W77-06793

DISTRIBUTION AND INDICATORY VALUE OF THE SUBMERGED MACROPHYTES IN THE FLOWING WATERS OF THE FRIEDBERGER AU, (IN GERMAN).

Universitaet Hohenheim (Landwirtschaftliche Hochschule) (West Germany).

A. Kohler, R. Brinkmeier, and H. Vollrath.

Ber Bayer Bot Ges Erforsch Heim Flora 45, p 5-36, 1974.

Descriptors: *Calcium, *Eutrophication, Distribution, *Indicators, Water pollution effects, Plant physiology.

Identifiers: *Callitriche-Obtusangula, *Macrophytes (Submerged), West Germany (Friedberger Au), *Katharobic waters.

The waters studied were high in Ca content. Some macrophyte species were found only in pure waters; other occurred mainly in pure waters but also in eutrophic sections. Some were more evenly distributed between katharobic and lightly polluted waters and others occurred in moderately and heavily polluted but not in katharobic waters. The Friedberger Au (West Germany) contained 14 hydrophytes and the Moosach system had 21. Callitriche obtusangula was totally absent from the former area but was among the most dominant species in the latter. --Copyright 1976, Biological Abstracts, Inc. W77-06802

COMMUNITY STRUCTURE, DISTRIBUTION, AND INTERRELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA. Oregon State Univ., Corvallis. Dept. of Zoology.

For primary bibliographic entry see Field 6G.

W77-06810

SHOREBIRD DEPENDENCE ON ARCTIC LITTORAL HABITATS. California Univ., Bodega Bay. Bodega Marine Lab.

For primary bibliographic entry see Field 6G.

W77-06811

AVIFAUNAL UTILIZATION OF THE OFFSHORE ISLAND AREA NEAR PRUDHOE BAY, ALASKA.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06812

BIRDS OF COASTAL HABITAT ON THE SOUTH SHORE OF SEWARD PENINSULA, ALASKA.
College of the Atlantic, Bar Harbor, Maine.
For primary bibliographic entry see Field 6G.
W77-06813

ECOLOGY AND BEHAVIOR OF SOUTHERN HEMISPHERE SHEARWATERS (GENUS PUFFINUS) AND OTHER SEABIRDS, WHEN OVER THE OUTER CONTINENTAL SHELF OF THE BERING SEA AND GULF OF ALASKA DURING THE NORTHERN SUMMER.
Calgary Univ., (Alberta).
For primary bibliographic entry see Field 6G.
W77-06814

SEASONAL DISTRIBUTION AND ABUNDANCE OF MARINE BIRDS.
Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 6G.
W77-06815

MIGRATION OF BIRDS IN ALASKA COASTAL AND MARINE HABITATS SUBJECT TO INFLUENCE BY OCS DEVELOPMENT.
Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.
For primary bibliographic entry see Field 6G.
W77-06818

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 2: FISH, PLANKTON, BENTHOS, LITTORAL.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-06825

THE DISTRIBUTION, ABUNDANCE, DIVERSITY AND PRODUCTIVITY OF BENTHIC ORGANISMS IN THE BERING SEA.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06826

SPAWNING HERRING SURVEYS IN THE BERING SEA AND FINFISH RESOURCE SURVEYS IN NORTON SOUND AND KOTZEBUE SOUND.
Alaska Dept. of Fish and Game, Anchorage. Div. of Commercial Fisheries.
For primary bibliographic entry see Field 6G.
W77-06828

PELAGIC AND DEMERSAL FISH ASSESSMENT IN THE LOWER COOK INLET ESTUARY SYSTEM.
Alaska Dept. of Fish and Game, Kodiak.
For primary bibliographic entry see Field 6G.
W77-06829

RAZOR CLAM (SILIQUA PATULA, DIXON) DISTRIBUTION AND POPULATION ASSESSMENT STUDY.
Alaska Dept. of Fish and Game, Kodiak. Div. of Commercial Fisheries.
For primary bibliographic entry see Field 6G.

W77-06830

RESOURCES OF NON-SALMONID PELAGIC FISH OF THE EASTERN BERING SEA AND THE GULF OF ALASKA.
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 6G.
W77-06832

BASELINE/RECONNAISSANCE CHARACTERIZATION, LITTORAL BIOTA, GULF OF ALASKA AND BERING SEA.
National Marine Fisheries Service, Auke Bay, Alaska. Auke Bay Fisheries Lab; and National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 6G.
W77-06833

PLANKTON OF THE GULF OF ALASKA - ICHTHYOPLANKTON.
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 6G.
W77-06834

INITIAL ZOOPLANKTON INVESTIGATIONS IN LOWER COOK INLET.
National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 6G.
W77-06835

PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN THE NORTHEAST GULF OF ALASKA.
National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 6G.
W77-06836

BASELINE STUDIES OF FISH AND SHELLFISH RESOURCES OF NORTON SOUND AND THE SOUTHEASTERN CHUKCHI SEA.
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 6G.
W77-06839

BEAUFORT SEA ESTUARINE FISHERY STUDY.
Alaska Dept. of Fish and Game, Fairbanks. Div. of Sport Fish.
For primary bibliographic entry see Field 6G.
W77-06840

THE DISTRIBUTION, ABUNDANCE, DIVERSITY, AND PRODUCTIVITY OF BENTHIC ORGANISMS IN THE GULF OF ALASKA.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06841

FOOD AND FEEDING RELATIONSHIPS IN THE BENTHIC AND DEMERSAL FISHES OF THE GULF OF ALASKA AND BERING SEA.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06842

RECONNAISSANCE CHARACTERIZATION OF LITTORAL BIOTA, BEAUFORT AND CHUKCHI SEAS.
Western Washington State Coll., Bellingham.
For primary bibliographic entry see Field 6G.
W77-06843

ICHTHYOPLANKTON OF THE EASTERN BERING SEA.
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 6G.
W77-06845

ASSESSMENT OF PELAGIC AND NEARSHORE FISH IN THREE BAYS ON SOUTHEAST KODIAK ISLAND.
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 6G.
W77-06846

DEMERSAL FISH AND SHELLFISH ASSESSMENT IN SELECTED ESTUARY SYSTEMS OF KODIAK ISLAND.
Alaska Dept. of Fish and Game, Kodiak.
For primary bibliographic entry see Field 6G.
W77-06847

TECHNICAL TRAWL SURVEY OF THE BENTHIC EPIFAUNA OF THE CHUKCHI SEA AND NORTON SOUND.
Alaska Univ., College. O.C.S. Coordination Office.
For primary bibliographic entry see Field 6G.
W77-06848

THE DISTRIBUTION, ABUNDANCE AND DIVERSITY OF THE EPIFAUNAL BENTHIC ORGANISMS IN TWO (ALITAK AND UGAK) BAYS OF KODIAK ISLAND, ALASKA.
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 6G.
W77-06849

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
W. D. MacLeod, D. W. Brown, and R. G. Jenkins.
NOAA Technical Memorandum ERL MESA-8, November 1976. 59 p, 18 fig, 12 tab, 11 ref, 2 append.

Descriptors: *Washington, *Coasts, *Baseline studies, *Water pollution effects, *Oil pollution, *Bioindicators, Sediments, Biota, *Mussels, *Snails, Analytical techniques, Organic compounds.
Identifiers: *Puget Sound, *Strait of Juan de Fuca, *Petroleum hydrocarbons, Residual hydrocarbons, Mytilus edulis, Mytilus californianus, Thais lamellosa.

Substantially increased petroleum tanker traffic, pipeline transport, and refining operations are anticipated in the region of Northern Puget Sound and Strait of Juan de Fuca when the Alaska pipeline comes into operation. To assess the potential future environmental impact arising from these activities current hydrocarbon baseline levels must be measured. This report presents the results of the pilot study and offers recommendations for a first year Petroleum Hydrocarbon Baseline Investigation. The pilot study has demonstrated that methodology exists to detect and measure a number of hydrocarbons in sediments, mussels (Mytilus edulis and Mytilus californianus), and a snail (Thais lamellosa). Appendices identify critical intertidal sites for further study and recommends analytical procedures best suited to the particular environment. (NOAA)
W77-06875

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

THE NEW YORK BIGHT PROJECT - 1975; STONY BROOK, LONG ISLAND, NEW YORK. National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 5G. W77-06876

IMPACT OF OIL SPILLAGE FROM WORLD WAR II TANKER SINKINGS, Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
B. Campbell, E. Kern, and D. Horn.
Sea Grant Program Report No. MITSG 77-4, Index No. 77-304. Nnt, January 1977. 93 p, 12 fig, 2 tab, 65 ref, 2 append. SG-04-6-158-44081.

Descriptors: *New Jersey, *North Carolina, *Oil spills, *Water pollution effects, Coasts, Estuaries, Environmental effects, Wildlife, Beaches, Economics, Baseline studies.
Identifiers: U.S. East Coast, Cape Hatteras, Historical background, Tankers, World War II.

The overall effects of spilled oil are studied through available data on tankers sunk along the East Coast of the United States during World War II. The baseline data of ships sunk, cargo, locations and data on sinkings was established through an extensive literature and archives search. Cape Hatteras, North Carolina and its surrounding area was chosen as the primary site of the investigation on the basis of the volume of spilled oil. A computer model was developed to estimate the trajectory of oil released from each ship. In addition, the Asbury Park area of New Jersey was investigated on the merit of substantial documentation of spills in that area. Interviews were conducted in both areas to obtain first hand information on visible effects of the oil. Newspapers and records of marine activities were analyzed to determine environmental and other oil related effects for the selected regions. Results indicated that effects of the oil spills, as observed by residents of the areas under investigation, were negligible. In both cases, regional wildlife and economy survived with minimal difficulty. (NOAA)
W77-06877

EFFECTS OF ENGINEERING ACTIVITIES ON THE ECOLOGY OF PISMO CLAMS, Moss Landing Marine Labs., Calif.
J. Nybakken, and M. Stephenson.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-016 948, Price Codes: A04 in paper copy, A01 in microfiche. Coastal Engineering Research Center, Fort Belvoir, Virginia, Miscellaneous Paper No. 8-75, September 1975. 65 p, 21 fig, 9 tab, 62 ref, 1 append. Army DACW72-72-C-0016

Descriptors: *Clams, *Surveys, *Beaches, *California, Distribution patterns, Aquatic populations, Aquatic animals, Sediments, Water quality, Coastal engineering, Predation, Reproduction, Gonads, Aging (Biological), Growth rates, Marine biology, Water pollution effects.
Identifiers: *Monterey Bay (Calif), *Pismo clams.

Three aspects of the ecology of Pismo clams were investigated in Monterey Bay, California: distribution, reproduction cycle, and age and growth. Pismo clam populations were found to be restricted to bay areas between the Salinas River and Santa Cruz. Highest densities recorded were in intertidal, and subtidal clam beds were few and with low densities. Most clams appeared randomly dispersed, and different size classes did not show a vertical separation. The presence and absence of clams were shown to be correlated with beach slope and grain size. Pismo clams mature in their second year in Monterey Bay, and the primary spawning time is in September and October. The growth rate is more rapid in young clams and varies throughout the year in all size classes but is most rapid in the summer and fall. The results of

this 2-year study can serve as a guide in sampling Pismo clam populations along the California coast; the density and distribution of the clam in Monterey Bay, and knowledge of spawning times can aid in project planning to avoid harming an important fishing resource. (Sims-ISWS)
W77-06886

MICROBIAL METHANE CONSUMPTION REACTIONS AND THEIR EFFECT ON METHANE DISTRIBUTIONS IN FRESHWATER AND MARINE ENVIRONMENTS, Alaska Univ., College. Inst. of Marine Science.
W. S. Reece, and D. T. Heggie.
Limnology and Oceanography, Vol. 22, No. 1, p 1-9, January 1977. 2 fig, 1 tab, 38 ref. NSF GA-19380, GA-41209.

Descriptors: *Methane, *Bacteria, *Methane bacteria, *Microbial degradation, *Water pollution sources, Gases, Microorganisms, Water pollution, Sulfates, Microbiology, Sulfur bacteria, Sediments, Microbiology, Sulfur bacteria, Sediments, Sulfur compounds, Marine bacteria, Water quality, Aquatic habitats.
Identifiers: *Methane oxidizing bacteria, *Methane producers, *Methane formation, Sulfate concentration, Sulfate reducers, Methane distributions, Marine environments, Microbial ecology, Marine systems.

A survey of reported methane distributions in sediments and the adjacent overlying water showed distinct differences between freshwater and marine environments. These differences may be explained by the activities of sulfate-reducing bacteria and appear to be the result of differences in sulfate concentration between freshwater and marine environments. (Henley-ISWS)
W77-06899

NUTRIENTS, CHLOROPHYLL, AND INTERNAL TIDES IN THE ST. LAWRENCE ESTUARY, Laval Univ., Quebec. Department de Biologie.
For primary bibliographic entry see Field 5B. W77-06910

A PRELIMINARY EVALUATION OF THE EFFECTS OF GAS BUBBLE DISEASE ON FISH POPULATIONS IN THE KOOTENAI RIVER BELOW LIBBY DAM, Army Engineer District, Seattle, Wash. Seattle District.
B. May.
Presented at the 25th Annual Meeting, Western Division, American Fisheries Society, July 13, 1973, 13 p., 5 tab., 2 ref. DACW 67-73-C.

Descriptors: *Trout, Freshwater fish, *Supersaturation, Fish populations, Freshwater fish, *Fish behavior, On-site investigations, Bioassays, Mortality, *Fish disease, Fish pathology, Rainbow trout, Dams, Dam sites, *Montana.
Identifiers: Fish, Game fish populations, *Kootenai River (Mont), *Mountain whitefish, Prosopium, *Cutthroat trout, *Gas bubble disease, Libby Dam (Mont), Creel Census, Recreational fishery.

Game fish populations have been adversely affected by supersaturated gases in the Kootenai River for at least five or six miles below Libby Dam. The spawning run of Mountain whitefish (*Prosopium williamsoni*) from the Kootenai River into the Fisher River was adversely affected by gas bubble disease. An unusually large drawdown of the reservoir in the winter of 1972-73 triggered the movement of large numbers of cutthroat trout (*Salmo clarki*) and mountain whitefish downstream out of the reservoir area. These fish provided an excellent fishery during February of 1973, but masked the effect of supersaturated gases upon fish populations in the first six miles of the Kootenai River below Libby Dam. Mountain

whitefish, appear to be more sensitive than cutthroat trout to supersaturated gas conditions. Depth, cold water temperatures and the influence of tributary streams allow some fish to survive for several months or more in areas of the river where total gas concentrations are above 130 percent saturation. (Katz)
W77-06919

OCCURRENCE OF GAS-BUBBLE DISEASE IN THREE SPECIES OF BIVALVE MOLLUSCS, Delaware Univ., Lewes. Field Station.
R. Malouf, R. Keck, D. Maurer, and C. Epitaino.
Journal of the Fisheries Research Board of Canada, Vol. 29 (1972), p. 588-589, 2 fig., 4 ref.

Descriptors: *Oysters, Commercial shellfish, Mollusks, *Diseases, Clams, Sea water, *Heated water, Atmospheric gases, *Supersaturation, *Animal pathology, *Aquaculture.
Identifiers: *Gas bubble disease, Bivalve mollusks, Conchiolin blisters, Mantle tissue, *Dissolved gas content, *Crassostrea gigas*, *Mercentaria mercenaria*.

Gas-bubble disease was observed in adult oysters and hard clams held in heated running sea water during the winter. Heating the cold sea water in closed heat exchangers caused it to become supersaturated with atmospheric gases. Exposure of the animals to this water the formation of gas-filled conchiolin blisters on the valves of the oysters. Bubbles of gas were observed in the gill filaments of the oysters and clams and in the mantle tissue of the oysters. Any method, such as the use of baffles or an aerated head tank, that reduces the dissolved gas concentration in the water will help prevent the diseases. (Katz)
W77-06921

FIRST REPORTED INCIDENCE OF GAS-BUBBLE DISEASE IN THE HEATED EFFLUENT OF A STEAM GENERATING STATION, North Carolina Wildlife Resources Commission, Raleigh. Div. of Inland Fisheries.
D. J. DeMont, and R. W. Miller.
In: Proceedings of the Twenty-Fifth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 1971, p. 392-399, 2 tab., 3 fig., 15 ref.

Descriptors: *Fish diseases, Warm water fishes, *Thermal pollution, Thermal power plants, Thermal water, Warm water fish, Freshwater fish, *Fish pathology, Industrial effluents, *Fish kill, Mortalities, *Environmental effects, Water pollution effects, White bass.
Identifiers: *Gas bubble diseases, *Steam generating stations, *Pop-eye, Threadfin shad, Bluegill, Black crappie, Gas emboli, Gills.

During the winter of 1970-71, thirteen species of warm-water fishes exhibited external symptoms of gas-bubble disease (mostly "pop-eye") in the discharge canal and cove of a steam generation station. Peak monthly incidences were 70.8, 33.3, and 23.5 percent for white bass, threadfin shad, and bluegill, respectively. Forty-nine percent of the bluegill in excess of 4 inches were afflicted, whereas only 4.4 percent of those under 4 inches exhibited symptoms. Among the bluegill, the right eye only symptoms were more prevalent than were the left eye only symptoms at the 97.5 percent confidence level. Dead fish, principally black crappie, observed in the discharge in February, 1971, did not exhibit external symptoms of gas-bubble disease. However, autopsies of dying black crappie revealed gas emboli in the larger vessels of the gill fragments. (Katz)
W77-06922

THE SOLUBILITY OF NITROGEN, OXYGEN AND ARGON IN WATER AND SEAWATER, Scripps Institution of Oceanography, La Jolla, Calif.
R. F. Weiss.

Deep-Sea Research, Vol. 17, 1970, p. 721-735, 11 tab., 4 fig., 24 ref.

Descriptors: *Nitrogen, *Oxygen, *Argon, *Seawater, *Atmosphere, *Solubility, *Thermodynamics, *Temperature, *Salinity, *Water quality, *Atmospheric pressure.

Identifiers: Distilled water, Bunsen solubility coefficient, *Solubility equations, *Nitrogen solubilities, *Oxygen solubilities, *Argon solubilities.

Recent precise data on the solubilities of nitrogen, oxygen and argon in distilled water and seawater are fitted to thermodynamically consistent equations by the method of least squares. The temperature dependence of the Bunsen-solubility coefficient is treated using the integrated van't Hoff equation. It is shown that the Setchenow relation gives an adequate representation of the salting-out effect. Equations expressing the solubilities of these gases, as a function of temperature and salinity, in units of the Bunsen coefficient, ml/l, and ml/kg are given along with solubility tables in each of these units. (Katz)

W77-06923

OBSERVATIONS ON GAS BUBBLE DISEASE IN ADULT COLUMBIA RIVER SOCKEYE SALMON (ONCORHYNCHUS NERKA),

Pacific Northwest Water Lab., Corvallis, Oreg.
G. R. Bouck, G. A. Chapman, P. W. Schneider, Jr., and D. L. Stevens.
Pacific Northwest Water Laboratory, 1970, 11 p., 3 tab., 9 ref.

Descriptors: Salmon, *Anadromous fish, *Columbia river, *Fish migration, *Animal pathology, Fish disease, *Supersaturation, Laboratory tests, Bioassays, Mortality, *Nitrogen, Water quality, Water pollution effects, Methodology, *Fish diseases, *Sockeye salmon. Identifiers: *Nitrogen, Supersaturation, *Gas bubble disease, External symptoms.

Gas bubble disease was confirmed in 1968 among wild adult sockeye salmon that were migrating upstream through the Columbia River. Adult fish had macroscopic gas bubbles in the skin and fins, and microscopic gas bubbles in the spleen and other organs. A similar survey in 1969 determined that gas bubble disease existed in at least 13 of a sample of 129 adult sockeye; 123 of these fish were randomly assigned to and then held at four temperatures in air-equilibrated water and the development of eye damage was noted. At temperatures below (10C) or at (16C) ambient river temperatures, about one-third of the fish became blinded in one or both eyes and sustained low mortality. At 20 and 22C eye damage developed in 53 percent and 66 percent of the fish, respectively, and was associated with high mortality. The authors conclude that dissolved nitrogen gas is an important water quality parameter causing significant damage to salmon in the Columbia River. (Katz).

W77-06924

DISSOLVED NITROGEN, DISSOLVED OXYGEN AND RELATED WATER TEMPERATURES IN THE COLUMBIA AND LOWER SNAKE RIVERS, 1965-1969,

National Marine Fisheries Service, Seattle, Wash.
K. T. Beiningen, and W. J. Ebel.
Available from the National Technical Information Service, Springfield, VA 22161 as COM-71 00640. Price codes: A04 in paper copy, A01 in microfiche. April 1971. 60 p., 95 tab., 6 ref.

Descriptors: *Columbia River, *Dissolved oxygen, *Nitrogen, *Water temperature, On-site investigations, Laboratory analysis, *Water quality, Limnology, *Data collection, Data storage, Grand Coulee Dam, Spillway, Dams, Dam sites, Saturation, *Supersaturation.
Identifiers: *Lower Snake River.

Data on the dissolved nitrogen, dissolved oxygen, and water temperatures in the Columbia and lower Snake Rivers from 1965 through 1969 are presented. The data were compiled from field observations and from laboratory analysis of water samples collected at 40 stations. (Katz)

W77-06925

EFFECT OF ATMOSPHERIC GAS SUPERSATURATION CAUSED BY DAMS ON SALMON AND STEELHEAD TROUT OF THE SNAKE AND COLUMBIA RIVERS (A REVIEW OF THE PROBLEM AND THE PROGRESS TOWARD A SOLUTION, 1974),

National Marine Fisheries Service, Seattle, Wash.
Northwest Fisheries Center.
W. J. Ebel, H. L. Raymond, G. E. Monan, W. E. Farr, and G. K. Tononaka.
Northwest Fisheries Center, Processed Report, January 1975, 111 p., 23 tab, 22 fig, 45 ref.

Descriptors: *Fish diseases, *Dams, Dam sites, *Salmon, Rainbow trout, *Columbia River, *Spillways, Fish migration, *Supersaturation, *Mortality, Animal population, Juvenile fish, Laboratory studies, On-site investigations, Spillway gates, Remedies, Nitrogen.

Identifiers: *Chinook salmon, *Steelhead trout, *Snake River, *Gas bubble disease, Nitrogen, Supersaturation, Spillway deflectors.

Dams constructed on the Columbia and Snake Rivers in the past decade have impounded most of the free flowing sections of these rivers and created a water condition that in high flow years is deadly to migrating salmon and steelhead trout. With high spills, the water becomes supersaturated with atmospheric gases to levels that are lethal to fish. In response to this problem, a major research effort is in progress which seeks to define the effects of supersaturation on fish and to develop methods of reducing supersaturation caused by dams. This report summarizes the present status of the research and the relation of our current information to the anadromous resources of the Columbia and Snake Rivers. Although our most complete information is on the salmon and steelhead runs of the Snake River, it is logical that the conclusions apply as well to the stocks of the upper Columbia River and to a lesser degree, to the runs entering the Columbia River below the Snake River. (Katz)

W77-06927

EVALUATION OF ALTERNATIVE SOLUTIONS TO GAS BUBBLE DISEASE MORTALITY OF MENHADEN AT PILGRIM NUCLEAR POWER STATION,

Yankee Atomic Electric Co., Westboro, Mass.
For primary bibliographic entry see Field 5G.

W77-06928

ALGAL SUPPLEMENT ENHANCEMENT OF STATIC AND RECIRCULATING SYSTEM,

South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Research Inst.

J. J. Manzi, and M. B. Maddox.
Reprinted from: Helgolander wiss. Meeresunters., Vol 28, p 447-455, 1976. 4 fig, 2 tab, 19 ref. Also as: SC Mar. Res. Contr. No. 65 and Brice Mar. Biol. Lab. Contrib. No. 43. SG 04-5-158-5, SG-04-6-158-44009.

Descriptors: *Monitoring, *Water quality, *Crustaceans, *Aquaculture, *Algae, Survival, Shellfish, Recirculated water, Sea water, *South Carolina.

Identifiers: *Macrobrachium rosenbergii, Phaeodactylum tricornutum, Prawns.

A comparative study of algal supplement enhancement of static and recirculating Macrobrachium rosenbergii larval culture was conducted. Algal supplements significantly increased larval survival

in both static and recirculating culture systems. Algal supplements significantly increased postlarval production in both static and recirculating culture systems. There was no significant difference in either survival or postlarval production between algal supplemented static and recirculating culture systems. The rate of larval development was appreciably increased by the additions of an algal supplement. The chemical parameters of water quality monitored did not appear to be related to the algal supplement enhancement of M. rosenbergii larval culture. (NOAA)

W77-06933

MONROE RESERVOIR, INDIANA, PART I: HYDROLOGIC CIRCULATION, SEDIMENTATION, AND WATER CHEMISTRY PART II: NUTRIENT RELATIONS,

Purdue Univ., Lafayette, Ind. Water Resources Research Center.
K. M. Bradbury, M. J. Graham, R. V. Ruhe, W. Y. B. Chang, and D. G. Frey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 258. Price codes: A06 in paper copy, A01 in microfiche. Technical Report No. 87. March 1, 1977, 117 p., 39 fig, 11 tab, 48 ref. OWRT B-074-IND(1).

Descriptors: *Lakes, *Lake sediments, *Aquatic productivity, *Eutrophication, *Deficient elements, *Sedimentation rates, *Water circulation, Soil types, Mesotrophy, Oligotrophy, Reservoirs, Thermocline, Nutrients, Nutrient requirements, Sediment distribution, *Indiana, Baseline studies, Post-impoundment.

Identifiers: *Lake Monroe(Ind), Inflow-outflow.

Monroe Reservoir completed in 1965 is about 10 miles south of Bloomington, Indiana on Salt Creek. The drainage area is about 432 square miles, and has a surface water area of 16.8 square miles at the low-flow regulation pool level. The watershed is on Mississippian Age bedrock. The study was to develop baseline information relative to the hydrologic circulation, sedimentation, water chemistry, and nutrient relations for this body of water. Using an inflow-outflow storage model and assuming total exchange of water by this system, the water is replaced 1.15 times in 5 months or wholly replaced in 4.3 months. With an input-output sedimentation model, the annual sediment deposition rate was found to be 10 acre feet which is 1/100 of 1% of the total storage space. The annual accumulation in the reservoir is about 0.02 acre feet on 25.5 tons per square mile and calculation for the 11 year life of the lake the average thickness of the bottom sediments is 0.13 inches. Although the chemical composition varied at the several sources of inputs, the waters of Lake Monroe are 'soft'. Lake Monroe was determined to be upper mesotrophic in its general trophic condition. No micronutrients were found to be limiting for the growth of phytoplankton and evidence indicated that phosphorus rather than nitrogen was the limiting macronutrient. (Wiersma-Purdue)

W77-06982

SOME FACTORS AFFECTING FLOC FORMATION BY ZOOGLOEA RAMIGERA, STRAIN I-16-M,

Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
For primary bibliographic entry see Field 5D.

W77-07042

PERSISTENCE OF POLIOVIRUS 1 IN SOIL AND ON VEGETABLES GROWN IN SOIL PREVIOUSLY FLOODED WITH INOCULATED SEWAGE SLUDGE OR EFFLUENT,

Food and Drug Administration, Cincinnati, Ohio. Virology Branch.
J. T. Tierney, R. Sullivan, and E. P. Larkin.
Applied and Environmental Microbiology, Vol 33, No 1, p 109-113, January, 1977. 3 fig, 3 tab, 23 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Viruses, *Sludge disposal, *Vegetable crops, *Vegetation, Sewage effluents, Drainage, Lettuce, Irrigation, Irrigation effects, Runoff, Soil types, Food chains.
Identifiers: Land disposal, *Poliovirus 1.

Studies were conducted to determine viral persistence in soil and on lettuce and radishes grown naturally in soil flooded with poliovirus-inoculated sewage. The results were compared with those from spray irrigation studies to investigate land disposal of sewage sludge and effluent. The average recovery of poliovirus from 100-gram soil samples was 82%. Plot runoff was periodically collected and monitored for virus. Data indicated that low virus levels were not detected. Laboratory studies indicated effective recovery efficiency until less than 100 PFU/100 grams were added to soil samples. No viruses were recovered at levels less than 10 PFU/100 grams of soil. A two week period was necessary before virus levels became undetectable and virus survival times determined in this study were probably minimum values. Recovery values would be different if sand or sandy soils were used at disposal sites. Other studies indicated that viruses percolate below the soil surface and that they are protected from the destructive effects of solar radiation and temperature. Results indicated that viruses may be present in soil and on crops harvested from land flooded with sewage sludge or effluent. It is possible that viruses are mechanically transmitted when these crops are harvested or consumed. Use of this method of sludge disposal might lead to contamination of the food chain but, if drainage could be controlled, use on vegetation other than in the food chain would be a beneficial disposal method. (Collins-FIRL)
W77-07050

SOLUBILITY AND PLANT UPTAKE OF CADMIUM IN SOILS AMENDED WITH CADMIUM AND SEWAGE SLUDGE.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-07055

5D. Waste Treatment Processes

ANAEROBIC DIGESTION AND MEMBRANE SEPARATION FOR THE TREATMENT OF DOMESTIC SEWAGE.
Thayer School of Engineering, Hanover, N.H.
H. E. Grethlein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 908, Price codes: A03 in paper copy, A01 in microfiche. New Hampshire Water Resources Research Center, Durham, Research Report No. 15, (1976). 26 p, 3 fig, 4 tab, 8 ref. OWRT A-034-NH(2).

Descriptors: *Anaerobic digestion, *Domestic wastes, *Waste water treatment, *Sewerage, Effluents, *Septic tanks, Membranes, E. coli, Turbidity, Phosphates, Nitrates, Biochemical oxygen demand, Nutrient removal.
Identifiers: *Anaerobic digesters.

A laboratory study was carried out on a new concept for treating domestic wastewater. It used a septic tank as an anaerobic digester, and a circulation loop which has a pump and a semipermeable membrane module. The flux was maintained by a cyclic operation for a flat sheet membrane model for 1300 hours, and 8300 hours for a Helicore Module. Not only were the turbidity and E. coli count zero in the effluent, but 85 to 95% BOD and 75% nitrate reduction were also observed. Phosphate reduction also occurred, but the reason for it is not clear. These results are encouraging enough to recommend further work.
W77-06631

MIXING AND CIRCULATION OF LAKES AND RESERVOIRS WITH AIR PLUMES,
New Hampshire Univ. Durham. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W77-06633

MEANS FOR PROTECTING THE DRINKING WATER QUALITY OF LAKE GEORGE, NEW YORK.
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5G.
W77-06682

NUTRIENT REMOVAL AND SLUDGE DISPOSAL WITHIN SEPTIC SYSTEMS-PHASE III.
Rensselaer Polytechnic Inst., Troy, N. Y. Fresh Water Inst.
N. L. Clesceri.
Rensselaer Polytechnic Institute FWI Report 76-10, February 1977. 24 p, 2 fig., 8 tab., 7 ref.

Descriptors: *Septic tanks, *Nutrient removal, *Soil types, Design, Phosphorus, Sorption, *New York, Sludge treatment, Waste water treatment.
Identifiers: *Lake George(New York).

Difference were examined in phosphorus sorption among soils representative of those found in the Lake George (New York) drainage basin and a rapid soil test was developed to estimate phosphorus sorption capacities of soils. The lake's drainage basin bedrock is close to the surface and has thin soil cover in many areas. Phosphorus sorption varied considerably with both soil type and soil horizons (i.e., the B horizon of each soil had a higher sorbing capacity than the C horizon) by a reference index using sorption at an equilibrium concentration of 6.2 ppm P (the approximate concentration of soluble orthophosphate in wastewaters). Data compiled on soil types can also be examined by length of time required to saturate a soil with P, using only one solution (20 ppm P) and a 15 minute shaking period. The resultant value can be used in conjunction with data on the design and use of a septic system to obtain relative estimates of the time required for saturation of the drain field with P (or the volume of soil needed in the drain field to allow operation of the system for a given number of years). (Auen-Wisconsin)
W77-06686

ADJUSTMENT COSTS AND OPTIMAL WASTE TREATMENT.
State Univ. of New York at Albany. Dept. of Economics.
J. D. Hartford.
Journal of Environmental Economics and Management, Vol. 3, No. 3, p. 215-225, 1976. 1 fig., 7 ref.

Descriptors: *Adjusted costs, *Waste treatment, *Optimization, *Model studies, *Waste water treatment, Regulation, Water quality standards, Pollution taxes(Charges), Economics, Marginal costs, Federal Water Pollution Control Act, Water pollution, Air pollution.
Identifiers: *Adjustment costs.

A policy of generally placing stricter standards on emissions and effluents and on ambient air and water quality, standards which take effect gradually over time, might be justified by one or more considerations raised in a study of the effect of adjustment costs on optimal levels of treatment. It is proposed that adjustment costs may be of significant practical importance in determining these levels over a given period of time. It is suggested that much of the future proposed levels of standards may not be reactions to estimated future increases in waste treatment, but simply a recognition that a more rapid approach to desired levels of waste treatment would entail excessive costs of

adjustment. The problem of minimizing the present value of the sum of treatment plus damage plus adjustment costs is placed in a calculus-of-variations framework and the optimal time path of waste treatment is characterized as well as the corresponding optimal tax. An example involving Euler differential equation statements is used to illustrate some features of the optimal waste treatment problem presented in the equations developed for minimization of adjustment costs. A conclusion is that the public sector in the U.S. should balance additional adjustment costs against the extra total costs of pollution caused by not being at the desired long-run level of treatment and prevention, and to decide the rate at which waste neutralization levels should be changed. (Harris-Wisconsin)
W77-06699

THE REMOVAL OF ORGANIC MATTER FROM WATER SUPPLIES BY ION EXCHANGE.
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
For primary bibliographic entry see Field 5F.
W77-06760

WATER DECONTAMINATION IN NORTHERN REGIONS BY IMPULSE ELECTRIC CHARGES, (IN RUSSIAN).
Tomskii Meditsinskii Institut (USSR).
E. G. Zhuk.
Gig Sanit. 38(10), p 8-11, 1973.

Descriptors: *Waste water treatment, *Disinfection, Industrial wastes, *Electrolysis, Microorganisms, Design, Treatment facilities.
Identifiers: *Impulse electric charges, Northern(USSR), Siberia.

Investigations were done in order to design a semi-industrial installation for water decontamination in Siberia and the extreme North (USSR) using impulse electric charges. This new method has an efficient and quick disinfection action.—Copyright 1975, Biological Abstracts, Inc.
W77-06791

SEPTIC TANK STUDY IS OFF AND RUNNING.
Water Conditioning, Vol. 10, No 11, p 8, 18, January, 1977.

Descriptors: *Water softening, *Waste water treatment, *Septic tanks, *Sewage bacteria, Soil disposal fields, Brine disposal, Saline water.
Identifiers: *Regeneration brines, Septic system bacterial fauna.

A Water Quality Association study of the effects of domestic water softeners on septic tank disposal systems is being conducted by the University of Wisconsin's Small Scale Waste Management Project. Due to the fact that nearly 60% of all water softener regeneration and backwash wastes are disposed of in septic systems this study is of some importance to both the water conditioning and septic tank industries. Analysis of septic tank effluent will be obtained either through literature search or sample analysis to determine base line salt concentrations when water softeners are used in septic systems. These concentrations will be compared with the critical levels established for septic systems. These concentrations will be compared with the critical levels established for septic tank bacterial fauna and the soil absorption bed to determine harmful effects, if any. Concentrated brines can be toxic to microorganisms necessary for the breakdown of waste organic materials within the septic system. The retardation or loss of biological treatment would allow waste solids to build up until the system fails to effectively remove particulate matter. These solids would then be washed out onto the absorption field and hasten soil clogging. Some work has already been done by the U.S.

Public Health Service and the University of California at Berkeley. (Heiss-NWWA)
W77-06859

NASA DEVELOPS WATER MONITORING SYSTEM,
Boeing Aerospace Co., Seattle, Wash.
For primary bibliographic entry see Field 5A.
W77-06912

FATE OF NITROGEN AND PHOSPHORUS IN SOILS UNDER SEPTIC TANK WASTE DISPOSAL FIELDS,
Agricultural Research Service, Beltsville, Md. Biological Waste Management Lab.; Agricultural Research Service, Beltsville, Md. Soil Nitrogen Lab.; and Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
For primary bibliographic entry see Field 5B.
W77-06914

ACTIVATED SLUDGE TREATMENT OF HIGH STRENGTH NSSC MILL EFFLUENT,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
P. H. M. Guo, W. K. Bedford, and B. E. Jank.
Technology Development Report EPS 4-WP-77-1, March, 1977, 76 p., 16 fig., 19 tab, 15 ref, 5 app.

Descriptors: *Activated sludge, Treatment, *Effluents, *Wastewater treatment, Pulp and Paper Industry, Performance, Foaming, Suspended solids, Aeration, *Pulp wastes, *Industrial wastes, Canada, Bioassay.
Identifiers: Neutral sulphite semi-chemical mills, Reactors.

Bench scale studies were carried out to investigate the feasibility of treating high strength Neutral Sulphite Semi-Chemical (NSSC) mill effluents using an activated sludge process. Wastewater from Dornier Packing Limited, Trenton, Ontario, was treated in a two-stage activated sludge system under different loading conditions. For comparison purposes, studies were conducted in a single-stage reactor operated as an extended aeration activated sludge system. Experimental results indicated that the activated sludge process was not suitable for the treatment of this wastewater. Sludge bulking, foaming and poor oxygen transfer were the major problems encountered. The high concentration of dissolved solids contributed significant error to the determination of suspended solids; however, a procedure was developed for adjusting values which were in error. Bioassay tests showed that untreated wastewater was toxic and activated sludge treatment did not significantly reduce the toxicity. (WATDOC)
W77-06945

DRYING POTATO WASTES FOR ANIMAL FEED AS AN ALTERNATIVE DISPOSAL METHOD.
Canadian Bio Resources Consultants Ltd., Surrey (British Columbia).
Economic and Technical Review Report EPS 3-WP-77-4, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, March, 1977, 85 p., 10 fig., 9 tab, 9 ref, append.

Descriptors: *Drying, *Potatoes, Wastes, *Feeds, Disposal, Food processing industry, Nutrient requirements, Livestock, Methodology, Economic feasibility, Industrial wastes, *Solid wastes, Dehydration, Waste disposal.
Identifiers: Dryers.

The solid wastes produced by the potato processing industry contribute significantly, in some cases, to pollution of the environment. This study was undertaken to evaluate the potential for dehydrating these waste solids for use as an animal

feed and, thus, reduce their disposal in environmentally unacceptable ways. This evaluation consisted of determining the marketability of dried potato waste in terms of conventional feedstuffs, assessing drying technology to determine systems applicable to dry potato processing waste, and assessing the potential market for a suitable drying system. The results of the study show that potato wastes can be dried economically and that the dried product can compete in the market as a high energy feed for ruminant animals. (WATDOC)
W77-06947

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1974-75,
Environmental Protection Service, Ottawa (Ontario).
J. J. Cameron, and D. W. Smith.
Economic and Technical Review Report EPS 3-WP-77-6, March, 1977, 154 p.

Descriptors: *Bibliographies, *Environmental engineering, Abstracts, Cold weather construction, Drainage, Municipal wastes, Municipal water, Pipelines, *Canada, Alaska, *Waste water treatment.
Identifiers: Northern Canada, Northwest territories.

The Northern Technology Centre has undertaken a program for preparing an annual bibliography of environmental engineering reports and papers. There are three parts to this document: an annotated bibliography, arranged alphabetically by author; a keyword index; and a special bibliography of conferences and other bibliographies. (WATDOC)
W77-06948

STATE-OF-THE-ART REVIEW OF PROCESSES FOR TREATMENT AND REUSE OF POTATO WASTES,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
J. P. Stephenson, and P. H. M. Guo.
Economic and Technical Review Report EPS 3-WP-77-7, March, 1977, 84 p., 3 fig., 16 tab, 65 ref.

Descriptors: *Reviews, Potatoes, *Byproducts, Reverse osmosis, Food processing industry, Bibliographies, *Waste water treatment, Effluents, Waste disposal, Sludge, *Recycling, *Water reuse, Industrial wastes.
Identifiers: *Potato processing wastes.

A review of the literature pertinent to the production and treatment of potato processing wastes is presented. The report outlines the unit operations (fluming, washing, peeling, slicing and blanching) employed in the industry with emphasis being placed on the french fry and potato chip sectors. Data on the quantity and quality of wastes generated from each unit operation were collected and analyzed. Results reported in the literature were compared with those obtained from a questionnaire survey conducted in the Canadian potato processing industry in 1973. In-plant measures for water conservation, water recycle and by-products recovery have been demonstrated as potential methods for reduction of waste loads. Biological processes such as activated sludge systems, trickling filters, aerated lagoons, waste stabilization ponds and rotating biological contactors were reported to be feasible for the treatment of the potato wastes. Land application of sludges produced from biological treatment systems has been most common for sludge disposal. (WATDOC)
W77-06949

PROCEEDINGS TECHNOLOGY TRANSFER SEMINAR ON WASTE HANDLING, DISPOSAL AND RECOVERY IN THE METAL FINISHING

INDUSTRY, NOVEMBER 12-13, 1975, TORONTO, ONTARIO.
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
Economic and Technical Review Report EPS 3-WP-77-3, 158 p., March, 1977.

Descriptors: *Waste disposal, *Metals, Recycling, Effluents, Mineral industry, Conferences, *Canada, *Waste water treatment.
Identifiers: Handling and recovery (Metals), *Metal finishing industry, *Technology transfer.

The Technology Transfer Seminar 'Waste Handling, Disposal and Recovery in the Metal Finishing Industry' was co-sponsored by the Environmental Protection Service, Environment Canada, the Automotive Parts Manufacturers' Association (Canada), and the American Electroplaters' Society. Topics related to recycle disposal and centralized treatment of metal finishing wastes, as well as the current status of government regulations. These proceedings include both the original papers presented by speakers at the seminar and transcripts of the extensive panel discussions which followed the presentations. Available technologies for water reduction in plating processes and various treatment operations, such as chemical precipitation, ion exchange, distillation and reverse osmosis, were reviewed and the economic and technical feasibility of recycling treated sludges and purified effluents was discussed. Much interest was expressed in the concept of centralized treatment plants, which are operating in Europe and, in particular, in Germany. The design, operation, maintenance and cost data for such plants are outlined along with discussions of sludge disposal problems. The possibility of applying this technology in Canada was discussed in relation to the current government attitudes towards the control of effluents from metal finishing operations. These proceedings reflect a balanced grouping of inputs from government, metal finishers, and technical experts. (WATDOC)
W77-06950

LITERATURE REVIEW OF WASTEWATER CHARACTERISTICS AND ABATEMENT TECHNOLOGY IN THE WOOD AND TIMBER PROCESSING INDUSTRY.
Economic and Technical Review, Report No. EPS 3-WP-77-2, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, February, 1977, 70 p., 2 app., 4 fig., 15 tab, 155 ref.

Descriptors: *Reviews, *Bibliographies, *Waste water treatment, *Pulp and paper industry, Pollution abatement, Technology, Storage, Water pollution, Recycling, Performance, Operations, *Canada, Pulp wastes, Industrial wastes.
Identifiers: *Literature reviews.

Published information pertinent to wastewater characteristics and abatement technology in the wood and timber processing is reviewed. The function of this report is to provide a background to the pollution abatement program being conducted by Environment Canada in this field. A complete inventory of the treatment and disposal of wastewater is required for the Canadian industries in order that a detailed appraisal can be made of the situation. It would appear that research is still necessary to develop complete design criteria for the application of treatment alternatives which are based on the best practicable technology available. The report consists of four major sections: (1) Log Storage, (2) Veneer and Plywood, (3) Particleboard, and (4) Wood Preserving. Each major section is discussed in terms of: wastewater sources (the industrial use of water and generation of wastewater, identifying the source and types of contaminants), wastewater characteristics (amounts of contaminants discharged and the potential environmental problems thus created) and abatement technology (the best practicable abatement control currently available and the cur-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

rent trends in industry). The conclusions reached are aimed at a preliminary assessment of the environmental status of the industry and identification of the significant information gaps. Recommendations concern the requirements for a comprehensive appraisal of the Canadian situation. (WATDOC)
W77-06951

LONDON'S STORMWATER PROBLEM,
Greater London Council (England). Water and Wastewater Section.
R. W. Horner, L. B. Wood, and L. R. Wroe.
Journal Water Pollution Control Federation, Vol. 49, No. 1, p 103-110, January, 1977. 1 fig, 2 tab, 3 ref.

Descriptors: *Storm water, *Storm runoff, *Drainage systems, *Floods, Urban drainage, Storm drains, Interceptor sewers, Combined sewers, Water quality, Analysis, Monitoring, Water quality.
Identifiers: London(England).

London's storm water problem and methods utilized to cope with it were reviewed. Six districts (central London, north-western, northern, north-eastern, south-eastern, and south-western) were described by characteristics of population, storm water conditions, and sewerage/drainage systems. A "standard storm" was selected to estimate storm water quantities discharged to rivers and streams for comparison of districts on a common basis. Instruments have been added at pumping stations, discharge mains, and culverts for water quality sampling. Basic principles used in controlling storm water were rapid removal of storm water from the area affected and storage for dispersal over a period greater than that of the storm at a rate close to the normal receiving stream flow. Studies indicated several effects of storm water on the Thames and its tributaries in the Greater London area. These include the depletion of dissolved oxygen in river water, where oxygen levels are dependent upon previous waterway conditions, flow quantity, and quality, and the spreading of pollution effects over a larger area when a storm occurs at rising tide. Possible control methods which were suggested included operating the sewerage system so as to contain as much of the dry weather flow within the system as possible; increasing intercepting sewer capacity to allow more storage and greater carrying capacity for storm water removal to treatment plants, storm tanks, or other areas; providing short term sedimentation or other treatment for pollution reduction; and aerating the river water to counter oxygen depletion. It was concluded that the major problem within the Greater London area was the control of storm water discharges. (Collins-FIRL)
W77-06983

CANWEL CAN DO,
H. H. Leich.
Compost Science, Vol. 17, No. 5, p 21, Winter, 1976.

Descriptors: *Waste water treatment, *Domestic wastes, *Water quality, *Treatment facilities, Water reuse, Environmental control, Sanitary engineering, Sewage treatment, Biological treatment, Chemical treatment, *Canada.
Identifiers: Ontario Research Foundation(Canada), Canwel sewerless sanitation system.

The Ontario Research Foundation has spent fifteen years developing the Canwel system of sewerless sanitation. The approach was developed under the assumption that central treatment plants cannot produce effluents which are nonhazardous to the environment and are not able to keep up with increasing demands upon them. Several avenues were investigated. Cleaning waste water to two levels, one good enough for recirculation to toilets, washing cars, and sprinkling lawns, and one pure enough for cooking and drinking, was the

first step. Others were ozonation rather than chlorination for purification and incineration of sewage sludge and kitchen garbage. The heat produced was used for hot water needs. Advantages of this system would be the elimination of sewer lines and central treatment facilities, lessening of home water requirements, meeting of hot water demand without added energy input, lowered costs for refuse collection, and significant increases in the quality of effluents released to ground or surface waters. A combination of physical, biological, and chemical processes would be used to run the system. Filtration and reverse osmosis techniques would reduce contaminant levels and increase water quality. Brine concentrates from this process could be incinerated with sludge and garbage. A prototype installation has been successful and the next step will be testing of the entire system in an apartment building. (Collins-FIRL)
W77-06985

SEWERAGE FOR A RURAL RESORT AREA,
Alexandria Lake Area Sanitary District, Minn.
J. A. Sullivan.
Public Works, Vol. 108, No. 2, p 56-57, February, 1977. 1 fig.

Descriptors: *Sewerage, *Treatment facilities, *Interceptor sewers, Engineering structures, Tertiary treatment, *Waste water treatment, Construction, Costs, Financing, Planning, *Minnesota.
Identifiers: Alexandria Lake Area Sanitary District(Minn).

A tertiary waste water treatment plant, 75 miles of sanitary sewers and 48 major lift stations are being constructed to provide sewerage for a 50 square mile area in rural Minnesota. Fifteen lakes and the groundwater in the area began to show signs of pollution during the late 1960's. This project was instituted to preserve the water resources of the area. A secondary treatment plant was completed in 1971, phasing out the two plant system previously employed. A comprehensive program including an activated sludge process, followed by alum coagulation and polymer filtration, chlorination, and final aeration in ponds was accepted by government agencies responsible for pollution control. Total costs of the project including engineering, administration, land acquisition and capitalized interest is \$23 million. Fourteen million dollars was obtained as grants from state and federal agencies. Operational costs are expected to be about \$1.1 million annually. All properties gaining lateral sewer benefit from the system will be assessed by special levy. The treatment plant and interceptor system have a design capacity of 2.5 and 3.2 mgd, respectively. Staff is expected to total 14 full-time employees and 2 part-time employees by 1978. (Collins-FIRL)
W77-06987

CHICAGO DRIVES LARGE BORES TO CONTROL COMBINED SEWAGE FLOW.
For primary bibliographic entry see Field 8E.
W77-06988

CINCINNATI'S PREVENTIVE MAINTENANCE SEWER PROGRAM.
For primary bibliographic entry see Field 5G.
W77-06989

PREVENTIVE SEWER MAINTENANCE HELPS PRESERVE HISTORIC ANNAPOLIS.
For primary bibliographic entry see Field 8G.
W77-06990

COPPER SULFATE FIGHTS ROOT GROWTH IN SEWER SYSTEMS.
For primary bibliographic entry see Field 8G.
W77-06991

SLIPFORM PAVER, STEEL FORMS SPEED LINING OF 25,000-FOOT SEWER TUNNEL.
For primary bibliographic entry see Field 8F.
W77-06992

CONTROL SEWER CORROSION WITH H₂O₂,
Corpus Christi Public Utilities, Tex.
For primary bibliographic entry see Field 8G.
W77-06993

CONTRACT SERVICES STRETCH SEWER MAINTENANCE BUDGET,
Gladstone Public Utilities, Mo.
For primary bibliographic entry see Field 8G.
W77-06994

NEW PROGRAMS IMPROVE SENSITIVE AREAS OF WATER AND SEWER SYSTEMS,
Waltham Public Works, Mass.
For primary bibliographic entry see Field 8G.
W77-06995

THE USE OF OXYGEN TO TREAT SEWAGE IN A RISING MAIN,
Water Pollution Research Lab., Stevenage (England).
A. G. Boon, C. F. Skellett, S. Newcombe, J. G. Jones, and C. F. Forster.
Water Pollution Control, Vol. 76, No. 1, p 98-112, 1977. 6 fig, 11 tab, 9 ref.

Descriptors: *Oxygenation, *Sewers, *Anaerobic conditions, *Sulfur compounds, *Anaerobic bacteria, *Sulfides, Odor, Corrosion, Dissolved oxygen, Suspended solids, Biochemical oxygen demand, Physical properties, Chemical properties, Sludge treatment, Sewage treatment, Pumping plant, Treatment facilities, Filters, *Waste water treatment.
Identifiers: Oxygen injection, Rising main, Leuconthrix, Bath(England).

Oxygen was used as a sewage treatment in rising and slow-flowing gravity mains to correct anaerobiosis which causes organic sulfur compounds and inorganic sulfates to be reduced to sulfide by specific bacteria growing in the sewage. Sulfide can lead to odor problems, concrete corrosion, and a sewage which is more difficult to treat at the receiving works. Testing was conducted in Bath, England. Average DO and total sulfide concentrations were 5 and 0 milligrams/liter, respectively, in the main and 0 and 8 milligrams/liter at the sewage works. Poor sludge settling characteristics at the facility were thought to be caused by Leuconthrix bacteria in the raw sewage. By injecting oxygen and maintaining sewage DO concentrations above 0.5 milligrams/liter, sulfur formation was prevented. The oxygen was injected at a point on the outgoing main. The theoretical maximum of oxygen needed was 1400 kilograms/day. BOD reductions were equivalent to between 70%, in winter, and 140%, in summer, of the mass of DO injected at the foot of the main. BOD in the final treatment effluent decreased from 58 to 21 milligrams/liter; suspended solids decreased from 51 to 21 milligrams/liter. Although the total weight of the sludge produced at the plant was only slightly affected by this treatment, the consolidated sludge volume was reduced by nearly 10%. Treatment produced an almost total reduction of Leuconthrix bacteria. During oxygen injection periods, there was an 8% increase in the daily power needed for sewage pumping because the flow rate decreased slightly. The annual cost of injecting oxygen to produce easily treatable sewage will be about 19,000 pounds. The alternative to this procedure, upgrading the biological filtration plant, would require an expenditure of 500,000 pounds. (Collins-FIRL)
W77-06996

ELECTRON-BEAM IRRADIATION OF WASTE PRODUCTS—E.G., FOR STERILIZATION OF SEWAGE SLUDGE AND WASTE INDUSTRIAL PRODUCTS.

French Patent FR 2298-363. Issued October 20, 1976. Derwent French Patents Abstracts, Vol. X, No. 48, p D3, January, 1977.

Descriptors: *Patents, *Equipment, *Sludge treatment, *Irradiation, Industrial wastes, Sewage treatment, Waste treatment, *Waste water treatment, Disinfection.

Identifiers: Sterilization.

A patent was issued for a sterilization process for wastes which can be stirred and mixed. The process involves irradiation of materials which flow into a chamber below an electron beam of 300-800 keV. Several parallel waste flow channels which are not transversely joined form the container. They have flat floors inclined to the horizontal and are connected by pumps and pipework. The radiation source covers the entire container and is perpendicular to the flow, producing a uniformly irradiated material. No excessive radiation is needed to treat thick layers. No protection and disposal problems are faced due to the lack of a strongly radioactive source. (Collins-FIRL)

W77-06997

SLUDGE SEPARATOR.

Australian Patent 478,919. Issued December 16, 1976. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol. 46, No. 47, p 4621, December, 1976.

Descriptors: *Patents, *Separation techniques, *Sludge treatment, Equipment, Sewage effluents, Sediments, *Waste water treatment, Waste treatment, *Treatment facilities.

Identifiers: *Sludge separators.

A patent was issued for a sludge separator apparatus to remove sinking and buoyant contaminants from sewage. The apparatus is cylindrical with a vertical axis, and separated into an upper and lower chamber by an insert which also produces a gap between the two chambers. Sewage flows into the lower chamber below the water level and sinking contaminants in the sewage influent are deposited on the vessel bottom while buoyant contaminants are captured on the insert surface facing the bottom. (Collins-FIRL)

W77-06998

OXIDATION AND OZONATION CHAMBER,

BDH, Inc., Rome, Ga. (Assignee).

J. H. Bowen.

United States Patent 4,007,120. Issued February 8, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 2, p 582, February, 1977. 1 fig.

Descriptors: *Patents, Equipment, *Oxidation, *Ozone, Oxygen, Liquid wastes, Waste treatment, *Waste water treatment, Chemical treatment.

Identifiers: Electrostatic charge, *Ozonation.

A patent was issued for an oxidation and ozonation chamber to treat liquids. The combined treatment chamber is composed of several compartments. These compartments contain a rotatable axle with a blade which creates an electrostatic charge by liquid agitation and mixes oxygen and ozone with the liquids. (Collins-FIRL)

W77-06999

HYDROCARBON PRODUCTS MANUFACTURE—BY CARBONISATION OF COAL, SCRAP RUBBER OR PLASTIC OR DOMESTIC SEWAGE UNDER REDUCED PRESSURE.

French Patent FR 2300-124. Issued October 8, 1976. Derwent French Patents Abstracts, Vol. X, No. 50, p D5, January, 1977.

Descriptors: *Patents, *Organic compounds, Equipment, *Domestic wastes, Resources development, *Waste treatment, Sewage treatment, Coal, Carbon, Natural resources, Oxygen, Chemical reactions.

Identifiers: Hydrocarbon products.

A patent was issued for a process to make hydrocarbon products from organic raw materials with coal or an analogous carboniferous material. The process can be applied to domestic sewage. The operation involves circulating the material through an elongated tubular element at a temperature of 425-98°C in the absence of oxygen at a reduced pressure of 50-150 mm Hg. The raw material is agitated as it enters the tube to increase surface area contacting the inner surface of the element. Reduced pressure in the process assures the removal of liquid and gaseous hydrocarbons before secondary reactions occur. (Collins-FIRL)

W77-07000

SEWAGE AERATION IMPELLER-WITH AUTOMATIC DE-ICING AND ANTI-CLOGGING SYSTEM.

K. Tofaute.

Soviet Patent SU-504-472. Issued April 30, 1976. Soviet Inventions Illustrated, Vol. X, No. 51, p D5, February, 1977. 1 fig.

Descriptors: *Patents, *Aeration, Equipment, *Sewage treatment, Biological treatment, Cleaning, *Waste water treatment, Oxygen, Waste treatment, Sewage effluent.

A patent was issued for a sewage water surface aerator employed in biological cleaning. Contamination of external surfaces is prevented by connecting tubes to these surfaces and the volume of the transport channels. The mechanism consists of a conical body with corrugated internal walls and external caps connecting the outer surface with the transporting channel volume. It is fixed to a drive shaft and, when rotated, the liquor is sucked into the transporting channel, mixed with air, and ejected by centrifugal forces. Oxygen from the air further aerates the dispersed liquor. (Collins-FIRL)

W77-07001

METHOD OF WASTE TREATMENT AND ALGAE RECOVERY.

California Univ., Berkeley. (Assignee).

W. J. Oswald.

United States Patent 4,005,546. Issued February 1, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 1, p 30, February, 1977. 1 fig.

Descriptors: *Patents, *Algae, *Sewage treatment, *Ponds, *Aerobic treatment, Air, Water purification, *Waste water treatment, Sewage effluent, Treatment facilities, Waste treatment.

Identifiers: *Algae recovery.

A patent was issued for a method of waste treatment and algae recovery involving three ponds. Sewage containing algae is retained in a pond open to light and air under natural conditions for 10 to 20 days. A portion is transferred to another pond open to light and air which is agitated for 3 to 6 days. Then a portion of the water in the second pond is transferred to a third that is substantially closed to light and remains quiescent for 1 1/2 to 3 days while algae settles. Settled algae is removed from this last pond. (Collins-FIRL)

W77-07003

RENOVATION OF WASTE WATER.

Ontario Research Foundation, Sheridan Park. (Assignee).

F. Besik.

United States Patent 4,008,159. Issued February 15, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 3, February, 1977. 1 fig.

Descriptors: *Patents, *Water purification, Suspended solids, Organic matter, Inorganic compounds, Nitrogen compounds, Odor, Adsorption, Biological treatment, Chemical treatment, Filtration, Coagulation, Microorganisms, Phosphates, *Waste water treatment.

Identifiers: Waste water renovation.

A patent was issued for a process to renovate waste water containing contaminants such as suspended solids, dissolved organic material, organic nitrogen-, ammoniacal nitrogen-, nitrite nitrogen-, and nitrate nitrogen-containing materials, phosphate material, odor-producing matter, and turbidity-producing material. The process subjects waste water to primary treatment for partial removal of dissolved organic matter, nitrogenous and phosphate matter, and turbidity-causing matter, followed by effluent removal to a second treatment zone where adsorption-biological treatment using activated carbon and microorganisms takes place. The effluent from this stage is treated with chemical coagulants, and then treated with ozone and oxygen. After the filtration of solids, renovated water is removed. (Collins-FIRL)

W77-07004

WASTE TREATMENT APPARATUS,

Ecolobrol, Inc., Bethpage, N.Y. (Assignee).

J. S. Jeris.

United States Patent 4,009,105. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1264, February, 1977. 1 fig.

Descriptors: *Patents, Equipment, *Biochemical oxygen demand, *Biological treatment, *Oxidation, Microorganisms, Filters, Oxygen, Carbon dioxide, *Waste water treatment, Organic matter.

A patent was issued for a treatment apparatus to biologically remove BOD from waste water. The equipment is composed of an elongated vertical container with a manifold near the bottom for control of waste water passage through the container, and an inlet for waste water that will be treated. Above the manifold is a fluidized bed of a solid particulate carrier with a layer of cultured microorganisms for BOD oxidation. There are means for adding oxygen to the bed which is arranged to receive the waste water and biologically convert most of the BOD to be removed to carbon dioxide, water, and cellular material. The waste water and carbon dioxide are continuously removed through an outlet, and the excess cellular material is removed from the particulate carrier. (Collins-FIRL)

W77-07005

PROCESS FOR THE TREATMENT OF WASTE WATER BY HETEROGENEOUS PHOTOSENSITIZED OXIDATION.

Temple Univ., Philadelphia, Pa. (Assignee).

J. R. Williams.

United States Patent 4,008,136. Issued February 15, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 3, p 929, February, 1977.

Descriptors: *Patents, *Light, *Oxidation, *Polymers, *Liquid wastes, Sewage effluents, Oxygen, Water purification, *Waste water treatment, Treatment.

Identifiers: *Photolysis.

A patent was issued for the treatment of waste water by heterogeneous photosensitized oxidation. This process is especially for waste water containing organic materials. A water insoluble polymer-based photosensitizer is added to the waste effluent in the presence of oxygen. The suspension is photolyzed by light with a wavelength between 320 and 800 nm. (Collins-FIRL)

W77-07006

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

METHOD OF APPLYING OZONE AND SONIC ENERGY TO STERILIZE AND OXIDIZE WASTE WATER

TII Corp., Lindenhurst, N.Y. (Assignee).
A. D. Henderson, and J. M. Periale.
U.S. Patents 4,003,832. Issued January 18, 1977. Official Gazette of the United States Patent Office, Vol. 954, No. 3, p 1203, January, 1977. 1 fig.

Descriptors: *Patents, *Ozone, *Sound waves, *Cavitation, *Oxidation, Water purification, Suspended solids, Coagulation, Polyelectrolytes, *Waste water treatment, *Sterilants.

A patent was issued for a method employing ozone and sonic energy to sterilize and oxidize waste water. A coagulating agent is added, followed by a polyelectrolyte to form a floc. The water is passed through a lamina to remove suspended solids, and is then passed in a counter-flow through a gravity gradient stand of water. The water is pre-treated with ozone and sonic energy to cause cavitation. Further treatment by ozone and sonic energy produces additional cavitation for effective oxidation and sterilization. (Collins-FIRL)
W77-07007

APPARATUS AND PROCESS FOR REMOVING AMMONIA NITROGEN FROM WASTE WATER

Ecotrol, Inc., Bethpage, N.Y. (Assignee).
J. S. Jeris.
U.S. Patents 4,009,099. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1262, February, 1977. 1 fig.

Descriptors: *Patents, Equipment, Water purification, Biological treatment, Oxygen, Ammonia, *Nitrogen, *Ammonia compounds, Microorganisms, Temperature, Oxidation, *Waste water treatment, Aerobic conditions.
Identifiers: Fluidized bed, Ammonia nitrogen.

A patent was issued for an apparatus and biological process to remove ammonia nitrogen from waste water. The process includes a fluidized bed of a solid particulate carrier with a cultured layer of nitrifying microorganisms. Waste water continuously passes through this bed, to which oxygen is added, and retained at a controlled temperature and length of time under aerobic conditions. This biologically converts most of the ammonia nitrogen to be removed from the waste water to oxidized forms of nitrogen, water and cellular material. These oxidized nitrogen forms and the water are continuously removed from the bed, as the excess cellular material is removed from the particulate carrier. (Collins-FIRL)
W77-07008

EXPANSION COMES QUICKLY TO AWT PLANT

Connell/Metcalf and Eddy, Coral Gables, Fla.
G. M. Lockward.
Water and Wastes Engineering, Vol. 14, No. 1, p 26-27, January, 1977. 1 tab.

Descriptors: *Treatment facilities, *Waste treatment, *Tertiary treatment, *Activated sludge, Equipment, *Waste disposal, *Waste water treatment, Design, Underground waste disposal, Automatic controls, *Florida.
Identifiers: *Miami-Dade(Florida) Water and Sewer Authority.

The Miami-Dade (Florida) Water and Sewer Authority has expanded a waste water treatment facility so that it can handle a 200% increase from 2.0 mgd to 6.0 mgd of influent. The additions were: new contact stabilization activated sludge units with minor modifications, rapid sand filtration units, expanded phosphorus removal equipment, expanded chlorination treatment with automatic dosing, new flow measuring devices, conversion

from outfall disposal to subsurface disposal, expanded sludge drying beds, added air blowers, added standby power capacity, expansion of the laboratory, and new office space. The activated sludge units can be easily altered to a conventional process involving aeration, but would require additional digestion tanks. This would also allow single-stage nitrification. When this change is effected, sodium aluminate will be used for phosphorus removal instead of alum. Though operating at 65% of capacity, the plant has proven successful in its effluent treatment. (Collins-FIRL)
W77-07009

THE FLIGHT AND PROMISE OF ON-SITE WASTE WATER TREATMENT

Interstate Electronics Corp., Arlington, Va.
A. Hershhaft.
Compost Science, Vol. 17, No. 5, p 6-12, Winter, 1976. 3 fig, 2 tab, 36 ref, 2 append.

Descriptors: *Waste water treatment, *Sewerage, *Municipal wastes, *Domestic wastes, *Septic tanks, *Cesspools, Treatment facilities, Pollution abatement, Water pollution sources, Planning, Costs, Treatment, Water conservation.
Identifiers: *On-site waste water treatment.

The problems faced in the development of on-site domestic sewage treatment stem from the assumption that such treatment is primitive and unlightened. However, it is being proposed as a viable alternative to centralized treatment systems. Prototype sewer systems were used as early as 3750 B.C. in an Indian culture. New York City, in 1805, built the first American sewer system and added a treatment plant in 1870. The present American system is basically the same as the Roman design with the addition of treatment facilities. Several drawbacks seen in the system of centralized sewerage are pollution of ground and surface waters, dispersal of toxic substances, groundwater depletion, induced development of communities, and high construction costs. These involve eutrophication and drawing water from aquifers to surface waterways. In 1973, the total cost for building municipal treatment and collection facilities which were eligible for Federal Funding was \$60 billion. On-site treatment usually involves some type of water conservation and effluent discharge into soil. Two types of on-site treatment are cesspools, and septic tanks. Studies are being made of the applicability of aerospace and advanced technologies to the improvement of on-site treatment. (Collins-FIRL)
W77-07010

TREATMENT OF SEWAGE BY ELECTRONS AND GAMMAS

Physics Today, Vol. 29, No. 12, p 20, December, 1976.

Descriptors: *Waste water treatment, *Sewage treatment, *Irradiation, *Ionization, Electronic equipment, Sludge treatment, Disinfection, Heat treatment, Toxicity, Viruses, Bacteria, Chemical wastes, Costs.
Identifiers: *Electron treatment, *Gamma ray treatment.

High energy electron and gamma ray treatment of sewage sludge for use as fertilizer was studied. MIT designed a facility to treat 100,000 gpd. A sludge slurry (2-5% solids) flows through an electron beam from a high-voltage accelerator which disinfects and destroys bacteria. Ionization may possibly break up toxic chemical pollutants such as PCB's and pesticides. Advantages of this system are the availability and controllability of the ionizing energy and the lack of radioactivity introduction into the treated matter. Economic analysis suggests the system may be practical. Sludge with 5% solids could be treated for approximately \$16/dry ton of sludge processed. Capital costs would be about \$500,000 and operational costs would be about \$120,000. A 400,000 rad exposure

eliminates coliforms and salmonella and reduces bacteria and viral counts. Sandia Laboratories, Albuquerque, New Mexico, investigated gamma ray sewage treatment. The system uses heat and radiation to produce liquid sludges suitable for soil conditioning and restoring depleted soils. Studies indicated possible restoration of treated wastes to the food chain as animal feed. A major advantage is the high penetrating capability of gamma rays. Economic feasibility has been projected for this system. Other experiments attempted to remove the curing process to allow treatment of larger waste volumes. Costs are estimated as \$3-5 per ton. (Collins-FIRL)
W77-07012

NEW VISIBILITY FOR ON-SITE WASTE TREATMENT SYSTEMS

S. Smyser.
Compost Science, Vol. 17, No. 5, p 12-14, Winter, 1976. 2 tab.

Descriptors: *Waste treatment, *Sewerage, *Treatment facilities, Sewage treatment, Domestic wastes, Industrial wastes, *Waste water treatment, Planning, Costs, Sewage disposal, Project planning, Projects, Economics.
Identifiers: *On-site waste water treatment.

A review was presented of EPA involvement in on-site waste treatment development and demonstration projects. This is an emphasized area because the economic and environmental costs of sewerage has greatly increased. Past EPA performance in this respect has been criticized as being inadequate and slow. Prohibitive costs make alternative developments a great need in many communities. It was revealed that the most detailed comparative cost information was from industry sources. One study indicated that individual composting toilets could produce a 79% saving over central sewerage in two small Massachusetts towns. Another study in Sterling, Connecticut, showed that the use of on-site composting units would eliminate annual operating costs, reduce water consumption by 40%, cut garbage disposal and chlorine costs, and make a zero-discharge situation possible. The lack of reliable information on composting systems is the major hindrance. Other studies and investigations reviewed were water recycling for garden fertilizing and the several far sighted efforts in Maine, New Hampshire, and Oregon relative to environmental planning: separated waste water systems, water use reduction schemes, and evaluation of self-contained sewage treatment systems. (Collins-FIRL)
W77-07013

UNOX SYSTEM FOR WASTE WATER TREATMENT

Union Carbide Corp., Tonawanda, N.Y. Linde Div.
D. E. Braunscheidel, and R. G. Gyger.
Chemical Engineering Progress, Vol. 72, No. 11, p 71-72, November, 1976. 1 fig.

Descriptors: *Waste water treatment, *Nitrification, *Bacteria, *Growth rates, *Toxins, *Ammonia, Temperature, Hydrogen ion concentrations, Dissolved oxygen, Biomass, Biochemical oxygen demand, Sludge treatment, Model studies, Economics.
Identifiers: UNOX, Monod model.

Various aspects of nitrification in waste water treatment were investigated. The Monod model was used as a convenient means of describing ammonia substrate removal and bacterial growth of nitrifying organisms. Specific cell growth rate is proportional to substrate concentration until a maximum is reached and it becomes independent of this factor. Nitrifying bacteria growth rates are determined by evaluating effects of temperature, pH, and dissolved oxygen levels. Mass balances for ammonia and bacteria are determined relative

to the activated sludge system. A relationship is formed between system sludge residence time (SRT) and the above parameters. A pH between 7.0 and 8.0 has been found preferable for nitrifying bacteria. Toxins and inhibitory substances suppress or inhibit bacteria growth. Experiments supported data predictions of the model. Single and two-step systems were described. The first system performs carbonaceous removal and nitrification in the same reactor at low organic loadings and long retention times. With low loadings, solids production per unit BOD₅ is low and oxygen use per BOD₅ unit is higher than in conventional carbonaceous systems. The two-step systems separate the two processes and carbonaceous removal is not as efficient as in the one step system. However, high food to biomass ratios allow low SRT's and small tank volumes. Influent is fed to the second step, low in BOD, allowing low food/biomass ratios and short SRT's. Total oxygenation tank volume of the two-step method is less or equal to that of the one step system. Oxygen consumption is higher and sludge production is lower in the one step process. Economics and waste water characteristics should determine the system used. (Collins-FIRL)

W77-07014

DESIGN AND CONTROL OF SECONDARY SETTLEMENT TANKS,

Water Pollution Research Lab., Stevenage (England).
M. J. D. White.

Water Pollution Control, Vol. 75, No. 4, p 459-467, 1976. 8 fig, 2 tab, 17 ref.

Descriptors: *Settling basins, *Sedimentation, *Design criteria, *Suspended solids, Sludge treatment, Nitrification, Denitrification, Flow, Equipment, *Waste water treatment, *Control.
Identifiers: Stirred specific volume, Stirred sludge density, Solids loading, Filamentous organisms.

The determination of settled volume at one solids concentration was studied as a parameter of the design and control of secondary settlement tanks. Solids loadings (mass flux) has two components—that of floc settling under gravity and that of sludge withdrawal from the tank bottom. Plotting the solids loading curve against that for solids concentration reveals the maximum solids loading. A method was given to make these determinations by assaying settled volume of mixed liquor in a stirred cylinder and dividing by the solids concentration to give the stirred specific volume (SSV) in milliliters/gram. The reciprocal of the resultant figure multiplied by 100, converting the units to percent, reveals the stirred sludge density (SSD). This experimental data measured the settling characteristics which were used to predict maximum solids loadings. Calculations made at a suspended solids concentration of 3.5 grams/liter were found adequate for these determinations. Results indicated that a low sludge return rate was best for design purposes. The concern was to decide on a SSV value. Design-related SSV predictions showed that SSV may be 80-140 milliliters/gram for partial-treatment plants with a sludge age less than 1.5 days with no nitrification; SSV of 100 milliliters/gram is good for plants with fully nitrified effluents and sludge age greater than 5 days; and SSV of 120-160 milliliters/gram is sufficient for plants with sludge age between 1.5 and 5 days. For settlement tank control, SSV calculations ensure a better determination of maximum solids loading. Maximum MLSS concentrations at a given flow rate or the maximum flow rate for a given MLSS can be calculated. In nitrifying plants, denitrification in the final tank and filamentous organism growth can be prevented by employing an anoxic zone. (Collins-FIRL)

W77-07015

FAST-TRACKING CUTS COSTS 16% ON ADVANCED WASTE WATER PLANT.

Engineering News-Record, Vol. 197, No. 26, p 47-48, December, 1976.

Descriptors: *Treatment facilities, *Construction, *Construction costs, *Sewage treatment, Sludge treatment, *Waste water treatment, *Tertiary treatment, Economics, Equipment.
Identifiers: Fast-tracking, Hillsboro(OR).

The construction of a 15 mgd advanced waste water treatment plant near Hillsboro, Oregon, involved the first application of fast-tracking in treatment plant building practices. This method resulted in a \$3.8 million saving and a completion date nine months earlier than with conventional methods. Savings were also realized by bidding the project in small packages, eliminating general contractor markup of subcontractor bids, and eliminating equipment markup. Forty-one of forty-eight contracts have been awarded and the project is 54% complete. Construction packages included excavation, raw sewage pump station, and construction of primary treatment facilities. Some consideration should be given to the fact that project approval time-lag might negate any time savings from fast-tracking. One advantage is that the owner will probably know more about the facility after construction, which may aid more effective operation. The plan involved a 10-year plan to replace six smaller and less efficient plants which will be dismantled. Salvageable equipment will be sold. The plant will be able to handle a 45 mgd peak flow. Primary treatment facilities include a raw sewage pump station, comminution basin, grit basin, four 100-foot diameter primary clarifiers and a primary sludge pump station. There is a pure oxygen activated sludge system and waste water will be treated with alum and polymers to remove phosphorus and remaining settleable organic matter. Advanced treatment sections will only be used during summer, and waste sludge will be used as fertilizer. Methane gas from sludge digesters will be used by the plant. (Collins-FIRL)

W77-07016

ACID SOLUBILIZATION OF SEWAGE SLUDGE AND ASH CONSTITUENTS FOR POSSIBLE RECOVERY.

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 5E.

W77-07017

FLUOSOLIDS INCINERATOR COMMISSIONED AT ESHER,

For primary bibliographic entry see Field 5E.

W77-07018

WASTE WATER SYSTEM USES MICROWAVES,

Chemical Engineering, Vol. 84, No. 3, p 77-78, January, 1977. 1 fig.

Descriptors: *Waste water treatment, *Microwaves, Water purification, Solid wastes, Liquid wastes, Treatment facilities, Coagulation, Filters, Polyelectrolytes, Disinfection, Ozone, Sewage effluents, Dewatering, Fertilizers, Landfills.
Identifiers: Watertek.

Sterilized, dry solids which are ready for disposal are produced by the six-step Watertek waste water treatment system that employs a microwave oven. The process produces liquid discharges which are clear, odor-free, and meet EPA 1983 waste water effluent standards. Settling ponds, digesters, and sludge beds are eliminated by this process. A more compact design is possible because liquid and solid wastes can be fully treated in 60 minutes. A 250,000 gpd system uses a space of about 30 x 40 feet, with a height of about 15 feet. Each step of the process forms a module of the system. In the first step solids are passed through a micro-screen filter and then to the oven, while liquid passes to a pressure vessel for the addition of air. A cationic polyelectrolyte polymer is added to the liquid and

the mixture moves to an air float chamber where micro-bubbles form. The polymer acts as a coagulant for solids which collect in the bubbles. A rotating skimmer collects the bubbles and they are fed to a vacuum filter and/or centrifuge and, then, to the oven. Water moves to an ozone disinfection cell for sterilization and is passed out of the carbon filter as a clear and contaminant-free solution. Solids are dewatered before entering the microwave oven and, depending on feed composition, can be used for fertilizer or landfill. (Collins-FIRL)

W77-07019

SLUDGE INCINERATION AT ESHER.

For primary bibliographic entry see Field 5E.

W77-07020

WASTE WATER TREATMENT PLANT BUILT IN WET HOLE,

G. Svenson.

Western Construction, Vol. 52, No. 1, p 32, 34, January, 1977.

Descriptors: *Treatment facilities, *Construction, *Construction costs, *Construction equipment, *Construction materials, Excavation, Concrete, Steel, Cranes, Fabrication, Tertiary treatment.

A \$16,630,000 tertiary waste water treatment plant is being constructed in an excavation. The completed facility will be entirely underground. Various stages of construction are carried on at the same time. Several interesting construction techniques are employed. Pre-fabrication of steel piping, a point-of-need warehouse system, and a 70-ton crane, capable of reaching all parts of the structures, contribute to cost savings. Vertical trenching was specified for all underground piping and, because the site is below groundwater levels, it is constantly dewatered. Steel piping was coated, lined and prefabricated at one plant, allowing piping delivery before schedule. Most concrete is to be below water levels and wells were scattered about the site to allow building below grade. Specifics of construction and transport methods were presented. (Collins-FIRL)

W77-07021

THE OPERATIONS SECTION OF LINCOLN SEWAGE DIVISION,

K. G. Pullen.

Surveyor, Vol. 148, No. 4411/4412, p 11-12, December, 1976.

Descriptors: *Water districts, *Operation and maintenance, *Personnel, *Budgeting, Mechanical equipment, Power operation and maintenance, Engineering personnel, Scientific personnel, Maintenance, Sludge treatment, Sludge disposal, Sewers, *Treatment facilities.
Identifiers: *Anglian Water Authority(England).

The personnel and management structure of the Operations Section of the Anglian Water Authority, England, was described. The headquarters staff consists of the operational services officer and the scientific officer and three area managers. The services officer is responsible for such activities as transport, communications, electrical and mechanical maintenance, and health and safety. The science officer advises on works performance and assists on process design. The lower personnel structure is described, as is the policy decision-making process. Maintenance staffs and their respective duties are outlined relative to sludge treatment and disposal, electrical and mechanical engineering, and sewerage. (Collins-FIRL)

W77-07023

ENERGY CONSERVATION AND HEAT RECOVERY IN WASTE WATER TREATMENT PLANTS,

Pirnie (Malcolm), Inc., White Plains, N. Y.
F. S. Pallio.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Water and Sewage Works, Vol. 124, No. 2, p 62-65, February, 1977. 4 fig, 7 tab.

Descriptors: *Energy, *Conservation, *Heat, *Heat pumps, Heating, Resource development, Refrigeration, Temperature, Performance, Costs, Equipment, Waste water treatment, Sludge treatment, *Treatment facilities.
Identifiers: Energy wheel.

Heat recovery has been considered as a useful approach to energy conservation in waste water treatment. Heat pumps, heat exchangers, and the energy wheel have been evaluated. Using processed waste water or other warm water sources for the heat pump provides a higher temperature source than that of ambient air. The Coefficient of Performance (COP) defines heat pump efficiency and is the ratio of useful heating output to the power input. The use of warm waste water results in a higher COP than air or water. Using heat pumps would allow recovery of available energy from waste water; provide 3 to 5 times more Btu/hr/kw than direct electric resistance heating units; have an economic advantage above oil-fired heating systems; and conserve energy resources. The energy wheel is a rotary air-to-air heat exchanger consisting of a revolving cylinder packed with coarse knit metal mesh. The cylinder rotates through an exhaust air stream, picks up heat, is purged of contaminated air, and finally, rotates through the outside air stream giving off the collected heat. Incoming cold air can be pretreated by using heat from the contaminated exhaust air stream. Other advantages are the reduction of cross contamination to less than 1%, and the availability of materials that allow moisture transfer from the exhaust to the incoming air stream, aiding recovery of sensible and latent heat from air-conditioned spaces. The use of the energy wheel can reduce the size of heating equipment, as well as the fuel and energy consumption. Both concepts can reduce annual heating costs. (Collins-FIRL)
W77-07024

MUNICIPAL WASTE WATER TREATMENT AS AN INDUSTRIAL OPERATION,
Environmental Quality Systems, Inc., Rockville, Md.
D. L. Guthrie.
Water and Sewage Works, Vol. 124, No. 2, p 60-61, February, 1977. 1 fig, 2 tab, 16 ref.

Descriptors: *Treatment facilities, *Operation and maintenance, *Municipal wastes, *Industrial wastes, *Costs, Legislation, Tertiary treatment, Pollution abatement, *Waste water treatment, Capital costs, Construction costs, Comparative costs.
Identifiers: Federal Water Pollution Control Act Amendments, 1972 (PL 92-500).

More advanced treatment processes, upgraded facilities, and better operation and maintenance procedures will be needed to comply with the treatment goals of PL 92-500. The costs involved require that facilities be operated as efficiently as possible to offset increased construction and operation costs. The capital investment in a municipal waste water treatment facility may reach \$10 million. The suggestion that municipal treatment facilities be operated on a basis similar to that of industrial plants was reviewed. These are operated for the most cost-effective and satisfactory results and can involve higher capital costs than municipal treatment plants. A comparison was suggested with a sulfuric acid plant. Variables involved in such a comparison were initial investment, amortization, plant age, number of employees, volume of production, dollar price of the end product, and raw material cost. For municipal waste water facilities, production volume is the combined volume of sludge and effluent and the dollar price of the end product is the cost to the taxpayer. It was concluded that water quality laws will not be successful unless municipal waste

water treatment is considered a profit-making operation rather than a burden. The final product is 'clean water' for the consumer. (Collins-FIRL)
W77-07025

PLUG-IN CONCEPT FOR PILOT SEWAGE TREATMENT PLANT,

J. Pullin.
Water and Sewage Works, Vol. 124, No. 2, p 52-53, February, 1977.

Descriptors: *Oxygenation, *Pilot plants, *Treatment facilities, *Tertiary treatment, *Biological treatment, *Chemical treatment, Construction, Design, Domestic wastes, Industrial wastes, Equipment, Personnel, *Waste water treatment.
Identifiers: Coleshill (England), NATO Committee on the Challenges of Modern Society (CCMS).

Waste water treatment by use of oxygenation is being studied at the advanced waste water treatment facility at Coleshill, England. The project is a pilot project for the NATO Committee on the Challenges of Modern Society (CCMS). The oxygenation is combined with conventional biological processes. The Coleshill facility has two treatment streams with a dry weather flow of 100,000 gallons/day. Treatment of both industrial and domestic flows and combination flows are being tested. Fixed facilities include a service gantry, inlet works, reagent preparation plant, sludge dewatering plant, laboratory and workshop, and a substation and office buildings. Mobile treatment units may be added at either side of the gantry to allow maximum flexibility at the works. These allow the combining of laboratory functional flexibility and full scale operation. Mobile units provide chemical flashmixing tanks; chemical flocculation tanks; settling tanks; recarbonation tanks; surface aeration tanks; biological filters; screw pumping units; multimedia filters; and granular activated carbon columns. Fixed facilities provide lime, ferric sulfate alum, polyelectrolyte, acid and carbon dioxide dosing; pilot scale multimedia filters; granular activated-carbon columns; storage tanks for biological and chemical sludges; and a sludge treatment house. Results have produced 99% phosphorus removal, 90% suspended solids reduction, 70% BOD removal and 65% COD reductions with the addition of 400 milligrams/liter of lime slurry. Portable sensors monitor all plant performance. (Collins-FIRL)
W77-07026

FAIL-SAFE WASTE TREATMENT SYSTEM,

CH2M/Hill, Reston, Va.
G. A. Gunn.
Water and Sewage Works, Vol. 124, No. 2, p 12, February, 1977.

Descriptors: *Treatment facilities, *Planning, *Waste water treatment, *Tertiary treatment, Chemical treatment, Environmental control, Water quality, Reservoirs, Natural resources, Construction, Automatic controls, Sewerage, Virginia.
Identifiers: Occoquan Sewage Authority (Va).

In order to prevent pollution of its water supply by sewage effluents, the Occoquan Sewage Authority, Virginia, has begun construction of an advanced waste water treatment system. This system will eliminate eleven treatment plants and will have many redundancy features to ensure operation under most foreseeable conditions. Funding of the project was aided by the EPA, the state of Virginia, and local government. A regional treatment facility will handle the loads now treated by the eleven facilities, and will employ a 15 mgd capacity, five raw sewage pump stations, and 150,000 lineal feet of interceptor sewers and force mains. Treatment will consist of primary and secondary treatment, chemical treatment for phosphorus removal, ion exchange for ammonia nitrogen removal, carbon absorption and multi-

media filtration for residual organics removal, and chlorination for disinfection and residual ammonia removal. Effluent quality should have a BOD of less than 1 mg/liter, zero suspended solids, a COD of less than 10 mg/liter, less than 2 coliform bacteria per 100 milliliters, and less than 0.1 mg/liter of phosphorus. The duplication of facilities includes two alternate off-site power sources and an on-site standby power generation system; an automatic by-pass of incoming raw sewage to an emergency retention basin during total power failure; and piping and valves designed to accommodate any failure. (Collins-FIRL)
W77-07027

PLASTIC SPHERES FOR WASTE WATER TREATMENT.

Water Services, Vol. 80, No. 970, p 737-738, December, 1976.

Descriptors: *Plastics, *Waste water treatment, *Industrial wastes, Biochemical oxygen demand, Equipment, Filters, Organic matter, Sewage effluent, Waste water treatment, Sewage treatment.

Mechanical purification systems have been developed using modifications of the activated sludge process which are more easily adapted to variations and shock loads. The Euro-Matic Bio-Drum was developed to combine the advantages of mechanical and natural purification processes. A pair of open mesh drums, filled with hollow plastic spheres which revolve around a shaft suspended by a 'swinging arm' attached to the side of the treatment tank are the basic mechanisms. This combines the trickling filter and activated sludge processes. The plastic balls are alternately dipped in liquor to take in organic matter, and exposed to the atmosphere, to absorb oxygen and generate biological activity. Results with hydraulic loads of 6 to 25 cu m/cu m/day and BODs from 1.2 to 4.7 kg/cu m/day showed reductions of 90% at lower loadings and 40% at higher loadings. With activated settled sludge returned to thicken the mixture in the tank, at 25 cu m/cu m/day and BOD of 5.5 kg cu m/day, a 90% BOD reduction was evidenced. Operation costs of a unit with a small single motor drive are minimal as is the installation cost. (Collins-FIRL)
W77-07028

SCREENINGS DEWATERING PRESS.

Water Services, Vol. 80, No. 970, p 737, December, 1976.

Descriptors: *Dewatering, *Screens, *Sludge treatment, Equipment, Treatment facilities, Incineration, Solid wastes, Waste treatment, *Waste water treatment.
Identifiers: *Dewatering press.

The Temact screenings dewatering press was developed to be used with sewage screens. It is made of a hydraulically operated press with a power and hydraulic control unit and an electrical control panel. Only interconnecting wiring, washing-down, and drainage facilities are necessary. Compression separates rags, paper, and like solids from liquid and fine matter which are subject to usual treatment processes. About two-thirds of the water is removed from screenings and weight and volume are reduced 55 to 60%. Discharged dewatered screenings are compact, relatively dry, and can be automatically bagged, if desired. They have a caloric value amenable to economical incineration. (Collins-FIRL)
W77-07029

SLUDGE DEWATERING ON ALASKA'S NORTH SLOPE,

Industrial Wastes, Vol. 23, No. 1, p 19, January/February, 1977.

Descriptors: *Dewatering, *Centrifugation, Separation techniques, Sludge treatment, Sewage

treatment, Flocculation, Polyelectrolytes, Biochemical oxygen demand, Disposal, Incineration, *Alaska, Arctic, Biological treatment, *Waste water treatment.
Identifiers: *North Slope(Alas).

Modern treatment methods that meet EPA regulations are being used in Alaska to replace traditional sewage disposal which usually involved ocean dumping. Techniques used on the North Slope are described. Two oil companies, Atlantic Richfield and BP Alaska, use a biological aerated sludge treatment system and a combined biological and physical-chemical system, respectively. Both, however, use continuous decanter centrifuges for sludge dewatering. Dewatering reduces the volume of sludge and improves its handling characteristics prior to disposal. Less consumption of water in the arctic lifestyle produces sewage with a high BOD or solids level. The ARCO base camp treatment system produces 450-500 pounds of cake concentrate and 5,000 gallons of clarified water per day from a waste water flow of 6 gpm containing 1-3% solids. The clarified water is recirculated to the sewage plant primary stage. Flocculation is induced in the sludge by the addition of polyelectrolytes just prior to centrifugation. This increases the rate of solids separation. The BP process handles feeds of 1-3% solids at 6 to 8 gpm, and 1% solids at 3 to 6 gpm. After dewatering, the cake concentration has 15-20% solids. The BP process reduces fuel costs for incineration, provides for continuous unmanned operation and an overload device to prevent serious breakdowns, and uses a closed system installation having operational flexibility. The De Laval decanter/centrifuges consist of a cylindrical bowl inside of which is a screw conveyor, both rotating in the same direction, though the conveyor moves at a different speed to transport separated solids to the solids discharge area. Solids and clarified water are simultaneously discharged. (Collins-FIRL)
W77-07030

SINGLE P/C UNIT REMOVAL OF NUTRIENTS FROM COMBINED SEWER OVERFLOWS,
O'Brien and Gere Engineers, Inc., Syracuse, N.Y.
C. B. Murphy, Jr., O. Hrycyk, W. T. Gleason, R. Field, and E. Fan.
Journal Water Pollution Control Federation, Vol 49, No 2, p 245-255, February, 1977. 8 fig, 2 tab, 7 ref.

Descriptors: *Overflow, *Combined sewers, *Nutrients, Separation techniques, Treatment facilities, Phosphorus, Ammonia, *Waste water treatment, Polymers, Design criteria, Aluminum, Lakes, Reservoirs, Surface waters, Tributaries.
Identifiers: Alum, Cinloptilolite.

An investigation, beginning with a pilot scale program and concluding with demonstration-scale facilities, was conducted to determine design criteria for the construction of a system to remove nutrients from combined sewer overflows. The unit developed was a high rate combined process using primary screening, in-line alum addition and coagulation, and contact with cinloptilolite. Alum dosages which produce an aluminum: phosphorus molar ratio of 1.2 to 1.8 removed 90-95% of the phosphorus. Phosphorus removal was not enhanced by excessive alum treatment. Polymer doses for removing solids depended upon the level of solids in the overflow waste water and on the solids generated by the alum. This system could be used to partially treat lake and reservoir tributaries with an algae problem during dry weather conditions, and to treat receiving streams immediately following a storm. Ammonia removal depended upon the NH₃N concentration in the influent, the volume of cinloptilolite used, and the waste water application rates. Ammonia removals of 0.36 mg/g (5.0 milligrams NH₃N/gram of cinloptilolite) were achieved. Three contractors in a series are necessary to optimize the use of cinloptilolite. This system is ideal for conditions where

treatment of a point source combined sewer overflow discharge is necessary, where space limitations do not allow conventional treatment, and where conveying waste water is impractical. (Collins-FIRL)
W77-07031

INFLUENCE OF PHOSPHORUS REMOVAL ON SOLIDS BUDGET,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
C. R. Baillod, G. M. Cressey, and R. T. Beaupre.
Journal Water Pollution Control Federation, Vol 49, No 1, p 131-145, January, 1977. 4 fig, 13 tab, 16 ref.

Descriptors: *Phosphorus, *Activated sludge, *Aerobic digestion, Chemical treatment, Biological treatment, Suspended solids, Sludge treatment, Dewatering, Physical properties, Chemical properties, *Waste water treatment, Economics.
Identifiers: Alum, Phosphorus removal.

A study was conducted to determine the influence of phosphorus removal on the solids budget of an activated sludge plant equipped with aerobic digestion. Specific objectives were the determination of the quantity, solids content, digestibility, and dewatering properties of the excess sludge produced, and the determination of the effect of alum addition on solids transformations within the activated sludge and aerobic digestion processes. An 81% total phosphorus removal was achieved with liquid alum doses of 1.7 moles of aluminum/mole of influent phosphorus. The same system without any chemical addition produced a 27% phosphorus removal. Chemical-biological activated sludge processes gave 50% more excess sludge on a dry weight basis and 16% more excess sludge on a volumetric basis. There was a marked net conversion or solubilization of the solids and phosphorus components to a dissolved form. In the control this was greater than in the alum unit. Volatile and fixed dissolved solids in both units showed net productions, and total solids, total fixed solids and phosphorus seemed to be conserved in each. Similar material balances for aerobic digesters showed the alum-biological sludge to be less amenable to aerobic digestion, but the alum sludge thickened much better than the control sludge. Alum-biological sludge total suspended solids reduction was low at about 12%. It was concluded that the aerobic digestion of chemical-biological sludge would be best for sludge storage and thickening. Dewatering studies indicated that both sludges were amenable to conventional processes. Two stage aerobic digestion followed by basket centrifugation seemed to be the most economical means of dewatering for the alum-biological sludge. (Collins-FIRL)
W77-07032

THE USE OF POLYMERS FOR IMPROVING CHEMICAL SLUDGE DEWATERING ON SAND BEDS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. Novak, and M. Langford.
Journal of the American Water Works Association, Vol 69, No 2, p 106-110, February, 1977. 13 fig, 3 tab, 8 ref.

Descriptors: *Dewatering, *Polymers, Drying, *Sludge treatment, *Waste water treatment, Solid wastes, Vacuum filters, Physical properties, Chemical properties, Economics.
Identifiers: Sand bed, Chemical sludges.

An evaluation was conducted of the effect of polymers on the improvement of sand bed dewatering of chemical sludges. Polymer conditioning was found to produce a sludge satisfactorily dewaterable on sand beds. Bed penetration was the condition which most frequently rules out sand bed use. Sludges of low cake solids and high specific resistance are considered most difficult to

dewater by mechanical means, but they are susceptible to sand-bed dewatering. The long period needed for air drying makes other methods more economical for dewatering dense sludges such as lime-softened sludges. Most sludges with a substantial CaCO₃ content have a relatively low resistance and can be dewatered by vacuum filter without added polymers. Specific characteristics of the sludge determine bed-surface requirements and the need for polymer conditioning. (Collins-FIRL)
W77-07033

TREATMENT OF COMBINED SEWER OVERFLOWS VIA THIN FILM CHEMISTRY,
New England Interstate Water Pollution Control Commission, Boston, Mass.
A. E. Pelouquin, S. E. Poole, and F. K. Schaffler.
Journal Water Pollution Control Federation, Vol 49, No 2, p 206-215, February, 1977. 4 fig, 5 tab, 3 ref.

Descriptors: *Combined sewers, *Overflow, *Storm water, Water purification, Disinfection, Equipment, Polymers, Chlorine, Sludge disposal, *Waste water treatment, Costs, Rural areas, Septic tanks, Treatment, Ozonation.
Identifiers: *Thin film chemistry, Sodium hypochlorite.

A new treatment system was described for combined sewer overflows and/or storm water discharges. Influent for the system is pumped from a manhole by two submersible screened-inlet pumps. It is discharged above the water line in a zone where mixing with lime and ferric chloride occurs. It is further mixed, an anionic polymer is added to aid floc growth, and then it is pumped into a high rate settler (HRS-1). Clarified waste water overflows to a flow equalization unit, and is pumped to a disinfection area, where it is disinfected by sodium hypochlorite using thin film technology. Disinfected waste water is pumped into HRS-2 and the effluent from HRS-2 is discharged into the river through a by-pass sewer. Sludge produced during treatment is discharged to the sewer line downstream of the influent manhole. This method is well-suited to treating overflows and an additional benefit would accrue from treating storm water mixed with the waste water. Cost reductions are expected from replacing chlorine with ozone, modifying chemical doses, and creating a new mixing system in the influent tank. Potential applications include treating small rural area waste water, septic tank pumpings, and holding tank wastes. (Collins-FIRL)
W77-07034

THE FABRIC-LINED PURIFICATION BASIN,
Journal of Coated Fabrics, Vol. 6, No. 3, p 137-138, January, 1977.

Descriptors: *Settling basins, *Linings, *Water purification, *Waste water treatment, Industrial wastes, Domestic wastes, Sewage effluents, Construction, Construction materials, Economics, Costs, Sealants, Roofing materials, *Plastics, *Treatment facilities.
Identifiers: Polyvinyl chloride(PVC), Diolen fabric.

The development of economical small and medium-sized waste water treatment facilities in Germany has become a major concern. This is primarily because waste water from nearly 50% of households and industries is still discharged unpurified. Excavated basins with feces-retaining membranes provide an economical solution to the problem. These basins may be covered or uncovered. Covered versions would allow placement nearer communities, thus eliminating expensive pipelines and odors, while providing a nonobjectional landscape. The prefabricated liner can be coated with polyvinyl chloride (PVC) as a sealant, and a PVC-coated high tenacity Diolen fabric can be used as a roofing material. (Collins-FIRL)
W77-07035

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

BACKWASHING OF GRANULAR FILTERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. L. Cleasby, J. Arboleda, D. E. Burns, P. W. Prendiville, and E. S. Savage.
Journal of the American Water Works Association, Vol 69, No 2, p 115-126, February, 1977. 10 fig, 3 tab, 53 ref, 1 append.

Descriptors: *Filters, *Cleaning, *Filtration, *Waste water treatment, Sewage treatment, Design criteria, Soil filters, Treatment facilities, Water purification.
Identifiers: *Backwash techniques.

Known practices and associated concerns for the backwashing of granular filters were summarized. This has become a field of interest due to the growing variation of practices used in the United States and abroad. The use of backwash techniques requires an awareness of potable water filtration technology since some backwashing methods involve full or partial fluidization of the filter media. High-rate backwashing is with full-bed fluidization and 20-50% bed expansion. Backwashing methods include: high-rate backwash; low-rate backwash; water backwash with surface-wash auxiliary; water backwash with air auxiliary; air scour followed by low-rate backwash with single-medium filters only; air scour followed by high-rate water backwash with single and multimedia filters; simultaneous air scour and low-rate water backwash followed by low-rate water backwash alone for single-medium filters only; and simultaneous air scour and low-rate water backwash followed by high-rate water backwash alone with single and multimedia filters. The choice of backwash method is partially dependent upon the type of filter medium selected. The various methods were described and further research was recommended. (Collins-FIRL)
W77-07037

EVALUATION OF IN-LINE AND SIDE-LINE FLOW EQUALIZATION SYSTEMS,
Johnson and Anderson, Inc., Pontiac, Mich.
G. W. Foess, J. G. Meenahan, and D. Blough.
Journal Water Pollution Control Federation, Vol 49, No 1, p 120-130, January, 1977. 6 fig, 6 tab, 9 ref.

Descriptors: Flow characteristics, *Flow control, *Flow rates, *Waste water treatment, Costs, Evaluation, Biochemical oxygen demand, Suspended solids, Filters, Performance, Phosphorus, Organic loading, Sludge treatment.
Identifiers: *Flow equalization, Side-line equalization, In-line equalization.

Experiments were conducted to evaluate flow equalization waste water treatment systems. Flow equalization has been considered a means of improving treatment processes and potentially lowering costs. One plant studied used a side-line equalization system where only above average flow was diverted through the equalization basin; the other used an in-line system where all plant flow passes through the equalization basin. Both were very effective in smoothing influent flow variations and producing a uniform flow rate to plant processes. Their effectiveness was limited in leveling concentrations. Mass leveling was more a result of flow equalization than waste water blending. A five percent BOD reduction was noticed in the in-line basin. Operational variables such as organic loadings, intensity, mixed liquor settleability, and wind and current densities were more important to effluent quality than flow equalization. Similarly, BOD₅, suspended solids, and soluble phosphorus removals resulted with and without flow equalization. Filter performance with flow equalization was superior to that with a diurnal flow. Power cost estimates indicated a less than 2% increase with flow equalization. (Collins-FIRL)
W77-07041

SOME FACTORS AFFECTING FLOC FORMATION BY ZOOGLOEA RAMIGERA, STRAIN I-16-M,
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
J. M. Krul.
Water Research, Vol 11, No 1, p 51-56, 1977. 7 fig, 1 tab, 13 ref.

Descriptors: *Flocculation, *Activated sludge, *Salts, *Growth rates, *Bacteria, Sewage treatment, *Waste water treatment, Biological treatment, Sludge treatment, Treatment.
Identifiers: *Zoogloea ramigera.

Studies were conducted to determine factors which influence floc formation by Zoogloea ramigera because it was long considered the major floc-forming organism of activated sludge. Floc formation was studied after resuspending pre-cultivated cells in fresh medium. The addition of NaCl or Na₂HPO₄/NaH₂PO₄ stimulated floc formation. Flocs of highly active cells were achieved because formation occurred within 1-2 hours. Results of this study indicated that adding CaCl₂ or Na₂SO₄ to fresh medium with resuspended pre-cultivated cells has no effect on floc formation. No explanation was found for the stimulation differences. Stimulated cell aggregation after resuspension of pregrown strain I-16-M cells was not generally characteristics of floc-forming bacteria. Ten floc forming strains, isolated from activated sludge and tested in the same manner, similarly failed to exhibit strongly stimulated cell aggregation. (Collins-FIRL)
W77-07042

THE EFFECT OF HIGH PURITY OXYGEN ON THE ACTIVATED SLUDGE PROCESS,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
L. D. Benefield, C. W. Randall, and P. H. King.
Journal Water Pollution Control Federation, Vol 49, No 2, p 269-279, February, 1977. 17 fig, 1 tab, 12 ref.

Descriptors: Analytical techniques, *Model studies, *Kinetics, *Activated sludge, *Oxygen, Air, Sludge treatment, Microorganisms, Growth rates, Treatment facilities, *Waste water treatment, Suspended solids, Evaluation.
Identifiers: Biochemical analysis, Substrate utilization.

An experimental design was developed to provide a valid comparison of substrate utilization and growth kinetics between air and oxygen activated sludge systems operated over a range of sludges found in normal plant operation. This design also included a biochemical analysis of sludge at various specific growth rates. Research indicated that differences in substrate utilization and cellular growth values for the two activated sludge systems occur when accepted methods are used for coefficient evaluation. The kinetic differences of the systems are due to the operational characteristics associated with small volume, high solids systems normally used with oxygen-aerated facilities. The failure of the volatile suspended solids test to distinguish between proliferating, active but non-proliferating, and inactive cellular material also contributes to this kinetic difference. (Collins-FIRL)
W77-07043

DRUGS AND DRUG METABOLITES AS ENVIRONMENTAL CONTAMINANTS: CHLOROPHENOXYISOBUTYRATE AND SALICYLIC ACID IN SEWAGE WATER EFFLUENT,
Veterans Administration Hospital, Kansas City, Mo.
For primary bibliographic entry see Field 5A.
W77-07045

PLANT DATA ANALYSIS OF TEMPERATURE SIGNIFICANCE IN THE ACTIVATED SLUDGE PROCESS,
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
K.-C. Lin, and G. W. Heinke.
Journal Water Pollution Control Federation, Vol. 49, No. 2, p 286-295, February, 1977. 4 fig, 3 tab, 18 ref, 1 append.

Descriptors: *Temperature, *Activated sludge, Design criteria, Performance, Evaluation, Treatment facilities, Biochemical oxygen demand, Suspended solids, Sedimentation, Aeration, *Waste water treatment, Monitoring, Illinois, Canada.
Identifiers: Chicago(IL), Toronto(Canada).

Research was conducted to determine the importance of temperature in the activated sludge process, to demonstrate the effect of temperature on activated sludge performance, and to evaluate the use of temperature data in the design and control of activated sludge. Data was gathered from plants in Chicago and Toronto. Results indicated that temperature was second to raw waste water BOD₅ and suspended solids concentrations in explaining BOD₅ and suspended solids removals. Analysis of 26-year plant data proved the adverse effects of low temperature on activated sludge performance. The effect of temperature on primary sedimentation alone has not been determined. A larger aeration tank volume is needed with low temperatures. Reactor volume varies inversely as the square root of reaction rate. Temperature drops may occur in process water in primary and secondary settling tanks, but a maximum temperature can be found in aeration tanks when hot compressed air is used. Raw waste water temperature should be monitored continuously, as well as mixed liquor temperature. Temperature control would increase BOD₅ removal. The use of hot compressed air in diffused aeration is preferred to mechanical surface aeration for maintaining high mixed liquor temperatures. (Collins-FIRL)
W77-07046

THE CHEMICAL CHARACTERISTICS OF THE CITY OF WINNIPEG WASTE WATER,
Winnipeg Waterworks, Waste, and Disposal Div. (Manitoba).
For primary bibliographic entry see Field 5A.
W77-07047

STUDY ON SEWAGE FLOW DYNAMICS THROUGH DORR TYPE CLARIFIER ON STREAM, (SYNOPSIS),
Technical Univ. of Warsaw (Poland). Inst. of Chemical Engineering.
A. Selecki, K. Zwolinski, A. G. Chmielewski, S. Babczynski, and K. Wild.
Chemie Ingenieur Technik, Vol. 49, No. 1, p 67, 1977. 2 fig, 3 ref.

Descriptors: Flow characteristics, *Dynamics, *Flow separation, *Sewage treatment, Tracers, Separation techniques, *Waste water treatment, Model studies, Effluents.
Identifiers: *Dorr type clarifier.

Results were presented from flow dynamics research with a Dorr type clarifier. With this apparatus, sewage enters a middle column under the liquid surface, sludge exits via outlets at the column bottom, and clear fluid reaches the sewer through the overflow. Radioactive tracers were added to the stream by an impulse method. Dynamic characteristics were studied by observations of residence time distribution function in response to the introduced pulse. Flow models were developed for an overcharged clarifier and for a normally charged clarifier. With an overall sewage flow rate of 750 cu m/hour, the clear liquid flow is nearly equal to plug flow with the occurrence of a sludge short circuit. No short circuiting occurred in the overcharged flow model. This may

be due to the fact that, at the given flow rate, streams outflowing from the diffusion cells in the column have significantly greater energy when compared to that at a flow rate of 451 cu m/hour. Experiments were conducted under severe conditions with results which were debatable. However, they may be considered a useful diagnostic method. (Collins-FIRL)
W77-07048

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: I. GENERAL INFORMATION ON SEWAGE FARM, SOIL, AND TREATMENT RESULTS.
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5G.
W77-07052

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: II. FRACTIONATION OF ACCUMULATED PHOSPHATES.
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5B.
W77-07053

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: III. KINETIC STUDIES ON THE REACTION OF PHOSPHATES WITH ALUMINUM COMPOUNDS.
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5B.
W77-07054

UNDERFLOW FROM SLUDGE-IRRIGATED CROPLAND.
Springfield Sanitary District, Ill.
For primary bibliographic entry see Field 5B.
W77-07056

AGRICULTURAL DISPOSAL OF AEROBIC WASTEWATER SLUDGES IN AN URBAN COUNTY.
Clermont County Water and Sewer District, Batavia, Ohio.
A. B. Clark.
Deeds and Data, p D-1, D-8, D-9, January, 1977.

Descriptors: *Sludge disposal, *Fertilizers, Odor, Agricultural chemicals, Crops, Farms, Equipment, Waste water treatment, Sludge treatment, Aerobic treatment, *Ohio, Waste disposal.
Identifiers: Clermont County(OH).

Agricultural disposal of aerobic sludges in Clermont County, Ohio, was reviewed. The county is rapidly developing from a rural area to a suburban one, mainly in the western portion. The eastern area is still largely agricultural. Gaining the acceptance of farmers for the use of their lands is a major obstacle. Once their concern for their property is allayed, the economics of commercial fertilizer use makes sludge application an attractive alternative. Any odor problem with this sludge type is relatively negligible, but application near the farmhouse is generally avoided. It is suggested that application be made first to grass crops because of the high nitrogen and water content which produces rather dramatic improvements. The most satisfactory application system developed involved using a rain gun designed for agricultural irrigation. It is mounted on a two wheel trailer and fitted with a 3.2 centimeter orifice. The gun throws a full or part circle and the sludge is evenly distributed. Four to twelve 7.5 cu m loads may be discharged in one setting. The system has been used on dry frozen fields after crop removal, wet fields in the process of thawing, soggy pasture land, dry plowed fields, and fields of growing corn. No indication of herbicide failure has been noticed. (Collins-FIRL)
W77-07057

CONDITIONING AND LAND APPLICATION OF AEROBICALLY DIGESTED SLUDGE.
Montgomery County Sanitary Dept., Dayton, Ohio.
T. Yates.
Deeds and Data, p D2-D-3, January, 1977.

Descriptors: *Sludge disposal, *Sludge digestion, *Aerobic treatment, Metals, Liquid wastes, Economics, Equipment, Soil disposal fields, Waste water treatment, *Ohio, Waste disposal.
Identifiers: Montgomery County(OH).

Many consider sludge conditioning and disposal to be the most difficult phases of waste water treatment. This is especially true of aerobically digested sludge. More efficient plants and increased industrial sludges add to the problem, as does the refusal of farmers and land owners to allow sludge application because of concern over metals and other sludge components. It is usually the most expensive portion of treatment, involving collection, transportation, processing, and final disposal. Gravity thickening of sludge is the most common process used in treatment plants. It is simple and inexpensive, unless there is a great distance to be traveled to the disposal site. The sludge produced is not as highly concentrated as that from other processes, causing more sludge to be transported. Most of the conditioning is done by wasting sludge gravity flow or pumping to aerobic digesters. The operation at the Montgomery County, Dayton, Ohio, plant was described. Because the plant has no sludge thickening equipment, polymers were added to a secondary settling tank to concentrate waste sludge. Methods of land application for sludge were discussed. Tank trucks may be used for transporting the sludge and spreading it on plowed farm land and pasture land, or it may be pumped from the side through a hose onto the land, if the area is not too wet to drive upon. A tractor with a vane-type vacuum-pressure pump can be used if disposal land is located near the treatment plant. More research was proposed to develop improved methods and equipment for sludge disposal. (Collins-FIRL)
W77-07058

ELIMINATION OF ANAEROBIC DIGESTER SUPERNATANT.
Envirex, Inc., Milwaukee, Wis.
N. A. Mignone.
Water and Sewage Works, Vol. 124, No. 2, p 48-49, February, 1977. 1 fig, 1 tab, 6 ref.

Descriptors: *Sludge digestion, *Anaerobic digestion, *Design criteria, *Sewage effluents, Sludge treatment, Dewatering, Heat treatment, Mechanical equipment, Treatment facilities, Separation, *Waste water treatment.

Secondary digesters are used to provide solid-liquid separation, thus reducing downstream sludge handling cost. Primary high rate anaerobic digestion combined with mechanical sludge dewatering may be more expedient. Present design practices produce a supernatant liquid stream that has a relatively poor quality. It has been felt that elimination of secondary digesters, and substitution of the above method, would not be detrimental to the treatment process. High rate anaerobic digestion and mechanical dewatering would not produce a variable supernatant stream, but one having a low solids content treatable by recycling to the influent of the secondary treatment process. Storage facilities to handle excess mechanical dewatering capacity would be unnecessary and primary digesters would provide enough non-sludge dewatering storage by using floating covers. Less land would be required. Raw sludge could be dewatered easily if the primary digester failed and a constant, predictable cake concentration would be produced for ultimate sludge disposal. (Collins-FIRL)
W77-07059

DESIGN CRITERIA FOR WASTE WATER AERATOR DRIVES.
P. Van Gelder.
Water and Sewage Works, Vol. 124, No. 1, p 66-69, January, 1977. 1 fig, 2 tab.

Descriptors: *Design criteria, *Aeration, Mechanical equipment, *Aerobic treatment, *Oxygenation, Water quality control, Treatment facilities, Legislation, Electrical equipment, Design, Corrosion control, *Waste water treatment.
Identifiers: *Aerator drives.

Because of stricter pollution control laws, industrial firms are beginning to develop new water treatment facilities with technology often beyond their normal spheres of operation. One important area is that of aerator drives. Mechanical aerators oxygenate ponded waste water to quicken aerobic digestion. Two basic aerator types are the fixed-platform and the floating aerator. An engineering survey is necessary to determine the one best suited for any application. Several considerations are presented, although the most important is the definition of application conditions. It has been found that a totally enclosed fan-cooled motor is the only one suited for aerator drives. Concern should be given to the choice of voltage, factors of insulation and service, corrosion-proofing, and other protective devices. The latter include temperature and overload protectors, condensation protection, and vibration protection. Safety factors relative to motor operation require that lifting devices withstand forces five times the weight of the motor; that excessive motor speeds be eliminated; and that there is proper grounding. Various factors affecting gear reducer and driver operation were considered, including gear case design, lubrication, and loading. (Collins-FIRL)
W77-07060

PURIFYING WATER.
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
In: CSIRO (Australia) Annual Report, No. 28, p 37-40, 1975/76. 2 fig.

Descriptors: *Water quality, *Water purification, *Water reuse, *Polymers, *Chemical treatment, Desalination, Sewage effluents, Industrial wastes, Heat treatment, Ion exchange, Resins, Pollution abatement, *Waste water treatment, *Australia, Water treatment.

Australian needs to purify water of poor quality for domestic and industrial use are expected to become urgent in the next 10 years. Desalination will be one of the processes used on a large scale for this purpose. Water from sewage and industrial effluents will also be recycled. Investigations are being made to study the use of polymers in water purification. Desalination with heat-regenerable resins used with polymer particles was thought to be economical, but micro-particles caused some handling problems. Techniques have been developed for the combination of acidic and basic micro-particles into conventional-sized composite beads which can be handled normally. Resins have successfully reduced water salt content from 3000 milligrams/liter to as low as 50-100 milligrams/liter. A desalination plant at Adelaide removes 80% of water salinity and produces 600 cubic meters of purified water per day. Modified polymers have been used for a great range of ion-exchange processes. Bicarbonate, calcium, magnesium ions, and heavy metals have been removed by these processes and they have been used to soften and decolor water. The use of resins has made possible a relatively continuous purification process since they are added at one end of a column and withdrawn and regenerated at the other. Magnetic polymers have been used as filter aids. Physical and chemical treatment processes studied include the use of lime treatment, ammonia stripping with air, coagulation with iron salts, sand filtration, chlorine disinfection, and activated carbon treatment. (Collins-FIRL)

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

W77-07061

UPGRADING BIOLOGICAL SEWAGE TREATMENT PLANTS TODAY,
Environmental Science and Technology, Vol. 11, No. 2, p 124-125, February, 1977.

Descriptors: *Treatment facilities, *Biological treatment, *Municipal wastes, *Chemical treatment, Aerobic treatment, Anaerobic conditions, Sludge digestion, Alkalinity, Hydrogen ion concentration, Nitrification, Lime, Settling basins, *Waste water treatment.
Identifiers: Sodium bicarbonate, Alum, Sodium hydroxide, Buffering.

Sodium bicarbonate has become a viable treatment chemical alternative. It is useful in adjusting pH, providing reserve alkalinity, and increasing efficiencies of aerobic and anaerobic processes. In a water treatment plant it can be added at any point giving access to the system. In secondary treatment plants, it can be added at the influent inlet of an aerobic system, at the primary settling tanks, or at the vacuum break of a digester. Sodium bicarbonate is most useful in plants with 5 mgd flow with mostly low pH or acidic wastes. The treatment is uneconomical with facilities having a flow less than this. It is safe to handle, a natural buffer, and cannot be overdosed. No amount of dosing produces a pH greater than 8.1 to 8.3. Sodium bicarbonate was not widely used in municipal sewage treatment because lime, alum, and other chemicals had been successful over the years. With stricter requirements for effluent quality and monitoring, evaluation of sodium bicarbonate and its subsequent use increased. The relative ease and safety of sodium bicarbonate use make it an attractive alternative, especially where pH levels above 6.5 are required. (Collins-FIRL)
W77-07062

STABILIZATION LAGOONS INCLUDING EXPERIENCE IN BRAZIL. PART 1,
R. M. Bradley, and M. O. S. Alvares Da Silva.
Effluent and Water Treatment Journal, Vol. 16, No. 12, p 619-622, 624-625, December, 1976. 1 fig, 6 tab, 40 ref.

Descriptors: *Design criteria, *Oxidation lagoons, *Aerated lagoons, *Anaerobic treatment, *Aerobic bacteria, Sewage lagoons, Photosynthesis, Sludge treatment, *Waste water treatment, Industrial wastes, Methane, Temperature, Hydrogen ion concentration, Biological treatment.
Identifiers: Aerobic lagoons, Facultative lagoons, Polishing lagoons.

Design criteria for stabilization lagoons are summarized. Under discussion are anaerobic, aerobic facultative, aerated, and polishing lagoons. Because numerous factors are involved in algal-bacterial processes, a rational design procedure is difficult to establish and many different methods are used. Principal factors which affect anaerobic lagoon purification efficiencies are temperature, pH, liquid detention time, and solids retention. Efficient methane production is ensured in a pH range of 6.8 to 7.2; BOD reduction is usually about 50% to 70%. The use of aerobic lagoons requires a knowledge of the density of algal cells and a method of relating oxygen production to light conversion efficiency and light intensity. A rational design procedure has been developed specifically for aerobic lagoons. Facultative lagoons achieve purification of organic wastes by aerobic and anaerobic processes in inter-related reactions, and many are designed on the basis of organic loading rates. Polishing lagoons are designed on the basis of detention time for the purpose of improving effluent which has received a high degree of purification by previous biological treatment. Increased algal growth and higher suspended solids levels and turbidity in the final effluent must be balanced against the increased reduction of bacteria and viruses resulting from longer detention times.

Specific design criteria, based on experience with stabilization lagoons, were presented. (Collins-FIRL)
W77-07063

THE CURRENT ROLE OF WASTEWATER DISINFECTION,

K. L. Murphy.
Water and Pollution Control, Vol. 115, No. 1, p 13-16, 36, January, 1977. 5 fig, 4 tab.

Descriptors: *Disinfection, *Waste water treatment, *Municipal wastes, *Chlorination, Coliforms, Pathogens, Water utilization, Infection, Environmental sanitation, Ammonia, Organic compounds.
Identifiers: Hypochlorous acid, Amino groups.

Disinfection has become a unit process in municipal waste water treatment, primarily because of the success of chlorination. This process reduces disease-causing enteric pathogens which would otherwise impair potable water sources, shellfish harvesting areas, and recreational resources. The number of coliforms in water for certain uses has been limited by law. Studies have been conducted to determine the relationship of water quality to risk of infection, but no concise conclusions have been drawn. In addition to chlorine, hypochlorous acid (hypochlorite ion), which reacts with ammonia and amino groups to form chloramines, is also used as a disinfectant. Studies relating to disinfection of waste water by these substances and their effects on pathogenic organisms are reviewed. Because effluent toxicity may be increased by chlorination, careful monitoring should determine whether overall benefits exceed negative environmental effects. (Collins-FIRL)
W77-07064

FUEL GAS AND ELECTRICITY FROM MUNICIPAL SEWAGE,

R. D. Bargman, and J. M. Betz.
In: Symposium on Clean Fuels from Biomass, Sewage, Urban Refuse, and Agricultural Wastes, January 27-30, 1976, Orlando, Florida, p 115-121. 4 tab.

Descriptors: *Fuels, *Methane, *Gases, *Activated sludge, Sludge treatment, *Biological treatment, Methane bacteria, Energy, Electricity, Treatment facilities, Microorganisms, *Waste water treatment, California.
Identifiers: Hyperion Treatment Plant, Los Angeles (Calif).

Methane gas can be a useful by-product of activated sludge treatment. This aspect of waste water treatment has gained interest since a federal law now requires secondary treatment of waste water before disposal. Methane gas is formed by a biological process during which micro-organisms decompose organic matter during sludge treatment. The City of Los Angeles, California, operates the Hyperion Treatment Plant which has produced methane by this process for 25 years. In this, as in most instances, methane gas production is insignificant in comparison to community needs, but is usually quite enough to operate machinery at the plant with the possibility of some excess as production. In addition to providing gas for diesel engines for driving compressors or producing electricity, this plant also provides energy for the start-up process of a nearby power plant in emergency cases. The total electrical energy produced by the plant is 140,000 kwh/day at a cost of \$.0120/kwh. The gas produced contains 65% methane and 35% carbon dioxide and provides about 94% of the fuel requirements of the plant's diesel engines. (Collins-FIRL)
W77-07065

SHORT COURSE PROCEEDINGS: APPLICATIONS OF STORMWATER MANAGEMENT MODELS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-07066

EXPERIENCE IN TREATING WASTE WATERS FROM THE DONETSK MINES, (IN RUSSIAN),
Donetsk Municipal Sanitation Epidemiology Station (USSR).
V. I. Solov'ev, N. V. Grin', E. A. Rodoshkevich, and I. I. Maiboroda.
Gig Sanit 3, p 95-97, 1976.

Descriptors: Bacteria, *Waste water treatment, Mines, Settling basins, Filters, Electrolysis, Electrothialysis, *Mine wastes, Water pollution.
Identifiers: *Donetsk (Ukrainian SSR), USSR.

Means of treating the 173,000 m³ daily waste water discharge containing bacteria from the Donetskugol' mines into the open reservoir of the city of Donetsk (Ukrainian SSR, USSR) are described. In the past 10 yr an extensive project was completed to replace horizontal settling basins with fountain ponds, rock filters, underground pressurized sand filters with electrolysis and an electrothialysis installation. Laboratory tests conducted between 1962-73 indicated substantial progress in reducing suspended particles in the Donetsk discharge waters.—Copyright 1977, Biological Abstracts, Inc.
W77-07068

HYGIENIC EFFECTIVENESS OF MEASURES FOR DECONTAMINATING EFFLUENTS AT PETROCHEMICAL PLANTS, (IN RUSSIAN),
Kazanskii Gosudarstvennyi Meditsinskii Institut (USSR).
F. F. Dautov.
Gig Sanit 4, p 102-103, 1976.

Descriptors: *Waste water treatment, Public health, *Industrial wastes, Water purification, Effluents, Chemical wastes.
Identifiers: *USSR (Kazan), *Petrochemical wastes.

The achievements of improved purification methods at Kazan Plant of Organic Synthesis (USSR), which include changes in technical processes, utilization of effluents and closed water cycles are outlined.—Copyright 1977, Biological Abstracts, Inc.
W77-07069

ADVANCED WASTE TREATMENT SEMINAR, SESSION III, REMOVAL OF SOLIDS AND ORGANICS, HELD AT SAN FRANCISCO, ON OCTOBER 28-29, 1976.

Federal Water Quality Administration, San Francisco, Calif. Pacific Southwest Regional Office. Available from the National Technical Information Service, Springfield, VA 22161 as PB-246 050. Price codes: A04 in paper copy, A01 in microfiche. FWQA Report, (1976). 69 p, 23 fig, 5 tab, 31 ref.

Descriptors: *Conferences, *Solids contact processes, *Design criteria, *Organic matter, Separation, Sedimentation, Filtration, Performance, Economics, Sludge treatment, Sludge disposal, Waste treatment, Waste disposal, Oxidation, Dewatering, Chemical treatment, Activated carbon, Oxygen, Oxygenation, Treatment, *Waste water treatment.

A report of a seminar on the removal of solids and organics in waste treatment was presented. Design criteria were presented for removal processes, such as horizontal and vertical-upflow sedimentation tanks, and tube and lamella settlers. Dissolved air flotation, screening devices, in-depth filtration, ultrafiltration, and activated sludge processes

were evaluated from performance and economic viewpoints. New developments in sludge handling and disposal were discussed, including ocean and land disposal, disposal of organic sludge, wet sludge treatment, oxidation, dewatering, and chemical treatment. Activated carbon treatment and the use of pure oxygen in solids removal were also evaluated. (Collins-FIRL)
W77-07074

ADSORPTION, COAGULATION AND FILTRATION MAKE A USEFUL TREATMENT COMBINATION—PART 2.
Rensselaer Polytechnic Inst., Troy, N.Y.
L. K. Wang, R. G. Ross, and V. J. Ciccone.
Water and Sewage Works, Vol. 124, No. 1, p 32-36, January, 1977. 2 fig, 5 tab, 17 ref.

Descriptors: *Waste water treatment, *Adsorption, *Coagulation, *Filtration, *Domestic wastes, Domestic water, Activated carbon, Polyelectrolytes, Sludge, Design criteria, Treatment.

The use of a mobile water purification unit in waste water treatment has been investigated. The unit combines adsorption, coagulation, and filtration processes. In testing, the mobile unit was adapted for treatment of kitchen, field laundry, and shower waste waters. The unit contained three 1500 gallon collapsible storage tanks and one blending tank of the same capacity for waste water equalization. Treatment also involves using powdered activated carbon, polyelectrolytes, sludge concentration, and a diatomite filter. Another change made was the use of the raw water pump for pumping waste water from the mixing tank to the Erdlator (upflow clarifier) tank. The unit was designed for transport on rotary and fixed-wing aircraft and general purpose lightweight ground vehicles. Each waste water stream was individually treated before combined treatment proceeded. Treatment results indicated turbidity removal of 99.9%, BOD removal of 81%, and TOC removal of 92%. (Collins-FIRL)
W77-07077

ANAEROBIC FILTER TREATS WASTE ACTIVATED SLUDGE.
Loyola Univ., Los Angeles, Calif.
R. T. Haug, S. K. Rakshit, and G. G. Wong.
Water and Sewage Works, Vol. 124, No. 2, p 40-43, February, 1977. 4 fig, 4 tab, 8 ref.

Descriptors: *Filters, *Anaerobic conditions, *Heat treatment, *Dewatering, Sludge treatment, Sludge disposal, Solid wastes, Pollution abatement, Disposal, Sewage effluents, Suspended solids, Activated sludge, *Waste water treatment, California.
Identifiers: Los Angeles(Calif).

The State of California has ruled against ocean disposal of waste water solids. The City of Los Angeles has studied alternate disposal schemes including treatment of liquors from thermal conditioning of waste activated sludge by anaerobic filters. This process involved thickening sludge and subjecting it to thermal conditioning at 350 F for about 30 minutes. As much as 60-70% of suspended solids were solubilized, producing a solids content of about 1.2% after conditioning. A 9% sludge was obtained with dewatering characteristics that produced a 40% cake after centrifuging without chemical additions. Thermal conditioning entailed several problems: odor control; corrosion and organic fouling of heat exchanger tubes; the need for heat energy; and necessary treatment of the decanted liquor and centrate (heat treated liquor) before disposal. The anaerobic filter was investigated for treatment of this liquor. The reactor provides an upward fluid flow through a fixed media bed. Very short hydraulic detention times and long solids retention time can be maintained easily. It cannot handle wastes with high concentrations of suspended solids. Because this

heat treated liquor has low solids concentrations, it was well-suited for the process. Results indicated 85% BOD removals and 76% COD removals with a 2-day hydraulic detention time; methane production would off-set much of the process energy requirement; and disposal by heat treating, followed by dewatering and thickening with an anaerobic filter treatment of the liquor, is a promising disposal method. Further research, however, is necessary. (Collins-FIRL)
W77-07078

LAND APPLICATION OF SEWAGE SLUDGE: IV. WHEAT GROWTH, N CONTENT, N FERTILIZER VALUE, AND N USE EFFICIENCY AS INFLUENCED BY SEWAGE SLUDGE AND WOOD WASTE MIXTURES.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
B. R. Sabey, N. N. Agdim, and D. C. Markstrom.
Journal of Environmental Quality, Vol. 6, No. 1, p 52-58, January-March, 1977. 3 fig, 4 tab, 18 ref.

Descriptors: *Sewage disposal, *Wheat, *Wood wastes, *Nitrogen compounds, Soil contamination, Water pollution, Growth rates, Organic matter, Inorganic compounds, Sludge disposal, *Waste water treatment, Fertilizers, Sewage sludge.
Identifiers: Land disposal.

A study was conducted to measure several parameters involving digested sewage sludge and wood waste materials and land application. These included total N and NO₃-N in wheat and total N, NH₄-N, and NO₃-N in soil after wheat harvesting. Inorganic fertilizer was added, with and without the organic matter, to aid evaluation of fertilizer potential of various rates and mixtures of organic materials on greenhouse-grown wheat. Four rates of sewage sludge and wood wastes, ranging from 22.4 to 224 metric tons/hectare, were used. Every mixture but 50% bark-50% sludge increased wheat growth. Greatest growth occurred at the 224 metric ton rate with 50% wood-50% sludge, 25% bark-75% sludge, and 25% wood and bark-75% sludge. Highest application rates of 100% sludge, 25% wood-75% sludge and 50% bark-50% sludge caused less growth than the next lower application rates. Equations were derived to express the relationship between wheat growth and N content in the plant tissue. Amounts of total N, NH₄-N, and NO₃-N remaining in greenhouse pots after harvest usually increased as the application rates of treatment increased. Care was suggested for application of 112 and 224 metric tons/hectare of 100% sludge and 25% wood-75% sludge, and 224 metric tons/hectare of 25% wood and bark-75% sludge due to possible NO₃-N accumulation and ground-water pollution. Ammonium N did not accumulate excessively. Estimations were that 2 to 22.7% initial N was taken up by plants during the study period of 50 days. (See also W76-10841) (Collins-FIRL)
W77-07079

APPLICATION OF MUNICIPAL REFUSE AND LIQUID SEWAGE SLUDGE TO AGRICULTURAL LAND: II. LYSIMETER STUDY.
North Carolina State Univ., Raleigh. Dept. of Soil Science.
L. D. King, A. J. Leyshon, and L. R. Webber.
Journal of Environmental Quality, Vol. 6, No. 1, p 67-71, January-March, 1977. 1 fig, 6 tab, 6 ref.

Descriptors: *Waste disposal, *Sludge, *Liquid wastes, Wastes, *Lysimeters, Nitrogen compounds, Municipal wastes, Nitrogen compounds, Leachates, Denitrification, Chemical oxygen demand, Oxygen demand, *Waste water treatment, Anaerobic conditions, *Water reuse, *Sewage sludge.
Identifiers: Land disposal.

A lysimeter study was conducted to determine whether agricultural land could be simultaneously

used for waste disposal-utilization and crop production. Liquid sewage sludge and unsorted, pulverized municipal refuse was used. Refuse was applied at 188 metric tons/hectare and a 2.3 centimeter depth of sewage sludge was applied separately and in combination. A double refuse-sludge rate and a control treatment were also studied. Results partially confirmed the assumption that the addition of refuse to sludge would create a C/N ratio which would allow enough N mineralization for crop growth but prevent excess leaching loss of NO₃-N. Compared to the sludge treatment, the combined treatment reduced NO₃-N by 33% and the refuse treatment caused leaching of NO₃-N equal to that of the control situation. Refuse treatment produced 43% more total corn yield than the control and released more nitrogen than the leachate data suggested. There was no significant difference between refuse and control treatment soil nitrate levels. The soil environment limited NO₃-N formation and favored denitrification in the combined treatment area, explaining the lack of significant NO₃-N leaching in the test. COD levels were high and the leachate had a septic odor, indicating anaerobic conditions in the lysimeters from the high oxygen demand of decomposing organic material. The amount of NH₄-N leached also supported this conclusion. Though the combined treatment is not a short term pollution problem relative to NO₃-N, highleachate COD and high Zn and Cd levels in plant material suggest this land application of refuse alone or in combination with sludge is an acceptable utilization/disposal method. (Collins-FIRL)
W77-07080

THE ELECTROLYTIC RESPIROMETER-II. USE IN WATER POLLUTION CONTROL PLANT LABORATORIES.
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. C. Young, and E. R. Baumann.
Water Research, Vol 10, No 12, p 1141-1149, 1976. 5 fig, 5 tab, 12 ref.

Descriptors: *Respiration, *Electrolysis, *Oxygen demand, *Oxygen requirements, *Biochemical oxygen demand, Evaluation, Pollution abatement, Nitrification, *Waste water treatment, Industrial wastes, Biodegradation, *Pollutant identification.

A study was conducted to determine the suitability of the electrolytic respirometer for in-plant BOD measurement, to evaluate its advantages, disadvantages, and range of use beyond single-point BOD measurement, and to collect electrolytic BOD data for comparison with standard dilution method BOD measurements. The study was in three parts, coinciding with these objectives. Conclusions and recommendations developed from resultant data were that the electrolytic respirometer provides reliable and precise measurement of BOD and should be accepted by pollution control agents as a supplement to or substitute for standard dilution; that data from a 3-day, 20 C electrolytic BOD test period are equal to that of a 5-day standard 20 C dilution test; that the ease of obtaining the complete BOD curve is a major advantage and helpful in evaluating industrial waste biodegradability; and that nitrification control should be a standard practice in BOD measurements conducted by any method. (Collins-FIRL)
W77-07081

PROCESS TECHNOLOGICAL BACKGROUND REGARDING NEW PROTECTIVE REGULATIONS OF WATER BODIES-RESULTS OF NITRIFICATION AND PHOSPHORUS ELIMINATION EXPERIMENTS IN ZURICH AND BERN. III. FILTRATION BY FLOCCULATION FOR THE ELIMINATION OF PHOSPHORUS FROM COMMUNAL WASTE WATER (VERFAHRENTSCHNISCHE UELAGEN IM HINBLICK AUF DIE NEUEN GEWAESSERSCHUTZANFORDERUNGEN-ERGEBNISSE DER VERSUCHE UEBER DIE

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

NITRIFIKATION UND PHOSPHORELIMINATION IN ZUERICH UND BERN. III. FLOCKUNGSFILTRATION ZUR ELIMINATION VON PHOSPHOR AUS KOMMUNALEM ABWASSER),
M. Boller.
Gas-Vasser-Abwasser, Vol 56, No 11, p 615-622, 1976. 15 fig, 4 tab, 11 ref.

Descriptors: *Filtration, *Flocculation, *Phosphorus, Analysis, Suspended solids, Costs, Cost-benefit ratio, *Waste water treatment, Performance, Evaluation, Filters, Design, Nitrification.

Advanced phosphorus removal process combinations with contact filtration as the last stage were evaluated in pilot scale experiments. The study indicated that contact filtration is especially feasible in the intake areas of lakes which are heavily loaded with phosphorus due to large point sources. The combination of contact filtration with other processes leads to very low phosphorus and suspended solids concentrations, averaging 0.1-0.4 milligrams/liter (phosphorus) and 0.5 milligrams (dry solids). An approximate calculation of annual costs for various phosphorus elimination processes and the annual costs per person for contact filtration combined with simultaneous precipitation indicated that they were about equal to those of a pH 9 post-precipitation system. More stable elimination performance and lower sensitivity to hydraulic shock loads are added advantages which shift the cost-benefit effect further in favor of contact filtration. Conclusions are reached concerning the design of contact filters for waste water treatment. (Collins-FIRL)

W77-07082

TRENDS IN SLUDGE TREATMENT AND DISPOSAL PRACTICES IN THE UNITED STATES,
Municipal Environmental Research Lab., Cincinnati, Ohio.
J. B. Farrell.

In: Polish/U.S. Symposium on Waste Water Treatment and Sludge Disposal, February 10-12, 1976, Cincinnati, Ohio, EPA Environmental Research Center, Cincinnati, Vol 2, p 11-17. 1 tab, 11 ref.

Descriptors: *Sludge treatment, *Sludge disposal, *Waste water treatment, *Environmental sanitation, Groundwater, Water pollution, Landfills, Sewerage, Incineration, Planning, Heavy metals, Standards, Fuels.
Identifiers: Ocean disposal, Composting, Pyrolysis.

Sludge disposal in the United States was a nuisance situation resulting from waste water treatment. Until recently, most sludge treatment procedures and equipment were borrowed from existing technology with little need for innovation. No standards were developed for sludge treatment which were comparable to those of waste water treatment. Cost has been the greatest factor in sludge treatment and disposal. This situation has begun to change. Several factors which now influence disposal include: process considerations, disposal choice, site and related circumstances, and ecological considerations. Protection and conservation have become major factors in treatment and disposal during the past decade. Oceans, as well as communities, must be protected from environmental dangers of improper disposal. Odor, particulate discharge, and groundwater pollution must be controlled or eliminated. Proper safeguards should be developed relative to incineration and landfilling. Resource conservation must also be emphasized. Efforts are underway to develop methods for control of sludge composition in sewers and landfills, incinerator standards for heavy metals, and fuel conservation in sludge treatment processes. The future seems to indicate discontinued ocean disposal, coincrenation and copyrolysis with solid wastes, conversion of sludge to other forms, and improved beneficial land disposal methods. (Collins-FIRL)

W77-07083

COMPOSTING OF SEWAGE SLUDGE AND SOLID WASTE MATTER,
Department of Waste Water Technology and Sludge Disposal, Warsaw (Poland). Local Economy and Environment Protection.
J. Cebula.

In: Polish/U.S. Symposium on Waste Water Treatment and Sludge Disposal, February 10-12, 1976, Cincinnati, Ohio, EPA Environmental Research Center, Cincinnati, Vol 2, p 18-32. 5 fig, 4 tab, 28 ref.

Descriptors: *Sludge treatment, *Sludge disposal, *Solid wastes, *Industrial wastes, *Municipal wastes, *Domestic wastes, *Heavy metals, Trace elements, Environmental sanitation, Organic matter, Analysis, *Sewage sludge.
Identifiers: *Composting, *Gluszyca (Poland).

Textile and chemical sludges were composted with municipal solid wastes at the Gluszyca, Poland, treatment plant to determine the value of composting in sludge management. Six areas were studied: treatment and preparation of sewage sludges for final disposal; characteristics of domestic wastes accumulated in the catchment area; joint sludge and wastes composting; role and effects of heavy metals on soils and plants; and practical aspects of sludge compost usage. Sludges were analyzed after dewatering and thickening. They contained less organic matter and essential components, in considering fertilizing and biological properties (C, H, N, P, K, Ca), than household solid wastes. The latter contained 61% fractions by weight and most of the organic matter suitable for composting. Sludge was difficult to dewater, emitted a disagreeable odor, and was greasy before composting. Afterwards the compost was not sticky and was easy to apply on soil. It stimulated plant growth. A 6 to 8% sludge content and 10 t/ha dose were considered optimum. Mathematical statistics were used to determine trace element occurrence distribution as well as the reliability of results. The variability of occurrence was found to be a useful tool in establishing the suitability of sludge for agricultural disposal and indicated the potential toxicity of soil under consideration. It was concluded that industrial composts were suitable for agricultural use. (Collins-FIRL)

W77-07084

EFFECT OF WATER WORK'S SLUDGE ON WASTE WATER TREATMENT,
Instytut Gospodarki Komunalnej, Warsaw (Poland).
J. Zakrzewski.

In: Polish/U.S. Symposium on Waste Water Treatment and Sludge Disposal, February 10-12, 1976, Cincinnati, Ohio, EPA Environmental Research Center, Cincinnati, Vol 2, p 33-41. 3 tab.

Descriptors: *Waste water treatment, *Sludge treatment, *Municipal wastes, Biological treatment, Activated sludge, Sludge digestion, Laboratory tests.
Identifiers: Post-coagulation sludge, Sludge thickening.

Results were presented of laboratory studies which evaluated post-coagulation sludge on municipal sewage treatment and municipal sludge disposal. Results indicated a limited effect on the mechanical treatment of municipal sewage and on activated sludge treatment of municipal sewage. The presence of post-coagulated sludge in raw sewage does not provide any important effect on mechanical-biological treatment of sewage. Addition of the study sludge slightly decreases thickening and sludge digestion. Further research is suggested to verify these conclusions. (Collins-FIRL)

W77-07085

RENOVATED WATER FROM MUNICIPAL SEWAGE TREATMENT PLANTS,
Wroclaw Technical Univ. (Poland). Inst. of Environmental Protection Engineering.
A. L. Kowal.

In: Polish/U.S. Symposium on Waste Water Treatment and Sludge Disposal, February 10-12, 1976, Cincinnati, Ohio, EPA Environmental Research Center, Cincinnati, Vol 2, p 141-150. 10 tab.

Descriptors: *Reclaimed water, *Trickling filter, *Activated sludge, *Coagulation, *Sedimentation, Carbon, Filtration, Sorption, Treatment facilities, *Waste water treatment, Laboratory tests, Pilot plants, Sludge treatment.
Identifiers: Renovated water, Recarbonation.

Laboratory and pilot tests were conducted to investigate the renovation of secondary effluent from a trickling filter and an activated sludge process. Coagulation, sedimentation, recarbonation, filtration and sorption were used. Trickling filter test results showed treatment efficiency as follows: 77.8% reduction of permanganate, 86.1% BOD removal, 33% ammonia nitrogen reduction, and 37.1% phosphate removal. The secondary effluent coagulated with lime or aluminum sulfate and was subjected to sedimentation, filtration on a sand bed, and passage through the activated carbon filters. Sewage was recarbonated with carbon dioxide before filtration when lime was used. A simultaneous coagulation with carbon slurry provided the best laboratory results. Pilot plant studies with aluminum sulfate or lime did not significantly remove ammonia nitrogen. Calcium oxide was reduced when filtered on a sand-anthracite bed and further reduced on a sand-carbon bed. Permanganate was significantly decreased, although sewer hardness was very high. Laboratory tests with the activated sludge reduced permanganate by about 50%, and removed phosphate and turbidity. High concentrations of either required high lime doses. Recarbonation was achieved by bringing carbon dioxide to the water and coagulating with lime, mixing rapidly, bringing pH up to 8.3, mixing slowly, settling, and decanting. The best alkalinity and hardness removal occurred with recarbonation after coagulation and sedimentation. Raised permanganate values were found in all recarbonated water samples. Coagulation with ferric or aluminum sulfate resulted in increased dissolved solids concentrations. (Collins-FIRL)

W77-07086

WASTE WATER REUSE PRACTICE IN THE UNITED STATES,
Municipal Environmental Research Lab., Cincinnati, Ohio.
C. A. Brunner.

In: Polish/U.S. Symposium on Waste Water Treatment and Sludge Disposal, February 10-12, 1976, Cincinnati, Ohio, EPA Environmental Research Center, Cincinnati, Vol 2, p 151-156. 4 tab.

Descriptors: *Water reuse, *Municipal waste water, *Water demand, *Waste water treatment, *Water conservation, *Water purification, Sewage treatment, Water sources, Groundwater, Irrigation, Domestic water, Lakes, Industrial water, Recreation.

The reuse of treated municipal waste water should be considered as an alternative plan for meeting future water demands. Present usage and future predictions of water demands make water resource conservation, renovation, and reuse of waste water imperative. Presently, waste water reuse is being applied to agricultural, industrial and recreational problems. Nonpotable domestic water applications are to be added to this group, as well as potable uses which may be practical at some future time. An EPA survey reported that 58% of water reused in 1971 was for agricultural purposes, with the great majority being used in irrigation. Forty percent was used for industrial needs. Much of this was used as cooling water. Recreational reuse programs include man-made

lakes. For these uses, water must be treated to maintain a low oxygen demand and to keep toxicity levels low. Domestic reuse schemes do not yet include potable water programs, and one problem is the necessity for a separate distribution system for the renovated water. Trace organics and pathogens, especially viruses, are the major restrictive agents in the development of water reuse programs for potable water needs. (Collins-FIRL)
W77-07087

SLUDGE DEWATERING PILOT PLANT DESIGN. PART 2.
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
P. M. Cheremisinoff.
Water and Sewage Works, Vol. 123, No. 12, p 64-67, December, 1976. 2 fig, 23 ref.

Descriptors: *Sewage disposal, *Dewatering, *Sludge treatment, Filtration, *Pilot plants, On-site tests, Treatment facilities, *Waste water treatment, Pumps, Temperature.

The design of a pilot plant for on-site or laboratory pilot testing was presented. The design was for a system which would operate during the entire cycle and have integrated recorders to graph pressure and total flow for the cycle. Criteria established included: a 15 gallon capacity and a filter press; the duplication of actual treatment and process control; equipment for chemical and heat treatment before dewatering; full instrumentation and recording devices for documentation of the filtration cycle for scale-up to the actual system; easy portability and ruggedness; a 3 to 10%, by weight, range for sludge suspended solids; constant pressure filtration; and automatic system controls. Design specifications were given for sludge storage and heat treatment vessels, chemical addition pumps, and the automatic control apparatus. (Collins-FIRL)
W77-07088

METHOD OF TREATING WASTE WATER WITH JET NOZZLES.
Badische Anilin- und Soda-Fabrik A.G., Ludwigshafen am Rhein (West Germany). Landwirtschaftliche Versuchsanstalt. (Assignee).
K. Hess, R. Stickel, O. Nagel, and R. Sinn.
United States Patent 4,009,100. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1263, February, 1977. 1 fig.

Descriptors: *Patents, *Activated sludge, *Aeration, Equipment, Gases, Air, Oxygen, Sludge treatment, *Waste water treatment, Water purification, Waste treatment, *Jets.

A patent was issued for a treatment process for activated sludge systems with aerating nozzles submerged in the waste water and activated sludge contained in a reservoir. A gas stream of air or high-oxygen gas is propelled through the nozzles, near the bottom of this mixture, into a small impulse exchange tube. A directional flow is produced in a rotary motion by ascending bubbles to create a screw motion flow in the waste water/activated sludge mixture. (Collins-FIRL)
W77-07090

WASTE TREATMENT PROCESS.
Ecotrol, Inc., Bethpage, N. Y. (Assignee).
J. S. Jeris.
United States Patent 4,009,098. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1262, February, 1977. 1 fig.

Descriptors: *Patents, *Waste water treatment, *Biochemical oxygen demand, *Oxidation, *Oxygen, Microorganisms, Suspended solids, Aerobic treatment, Aerobic conditions, Waste treatment.

A patent was issued for a waste water treatment process for BOD removal. Waste water passes through a bed of microorganisms which oxidizes BOD under aerobic conditions and allows suspended solids to pass through it. This produces an upflow fluidized bed of solid particulate carrier by passing waste water up at a flowrate of 6+ gallons/minute/square foot of bed. About 1.5 milligrams of oxygen per milligram of BOD removed from the waste water are provided to allow the microorganisms to reduce BOD. Specific gravity of the particles is increased by removal of excess microorganism growth from the bed to aid BOD removal. Floc produced by excess growth removal is taken from the process without any interference with operational efficiency. (Collins-FIRL)
W77-07091

CLARIFIER WITH OVERFLOW SCUM REMOVAL.
Envirex, Inc., Milwaukee, Wis. (Assignee).
G. W. Smith.
United States Patent 4,009,106. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1265, February, 1977. 1 fig.

Descriptors: *Patents, *Separation technique, *Waste water treatment, Sewage treatment, Equipment, Water purification, Sewage effluents, Treatment, Sludge.

Identifiers: Clarifier, Scum removal.

A patent was issued for a sewage treatment clarifier. The clarifier has a circular outer wall with submerged feed ports, a conical bottom defining a lower sludge collection area, a sludge return line from the lowest portion of this area, and a circular overflow launder that establishes the normal liquid level in the clarifier. A circular scum trough, a frusto-conical baffle, and a scum collection zone are other features of the system. (Collins-FIRL)
W77-07092

PROCESS FOR THE PURIFICATION OF WASTE WATERS WITH ACTIVATED CARBON.
Bergbau-Forschung G.m.b.H., Essen (West Germany).
G. Gappa, H. Juntgen, and J. Reichenberger.
United States Patent 4,007,116. Issued February 8, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 2, p 581, February, 1977. 1 fig.

Descriptors: *Patents, *Waste water treatment, *Activated carbon, Organic carbon, Treatment facilities, Equipment, Sewage treatment, Sewage effluents, Water purification, Sanitary engineering.

A patent was issued for an activated carbon waste water treatment process. Waste water is passed upward through a column of activated carbon particles and distributed equally over the cross-sectional area. Total organic carbon is determined before water enters the column and simultaneously at a point between 30 and 70% of the carbon particles height in the column. Spent carbon particles are withdrawn from the column bottom at a rate which maintains a selected difference between total organic carbon content of water entering the column and at the above selected point. Fresh activated carbon or reactivated carbon is constantly introduced at the column top to compensate for the withdrawal. Purified water is recovered at the top of the column. (Collins-FIRL)
W77-07093

OZONE OXIDATION OF WASTE WATER.
Cubic Corp., San Diego, Calif. (Assignee).
D. F. Ciambrone.
United States Patent 4,007,118. Issued February 8, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 2, p 581-582, February, 1977. 1 fig.

Descriptors: *Patents, *Oxidation, *Ozone matter, *Bacteria, *Waste water treatment, Oxides, Equipment, Metals, Sewage treatment.

A patent was issued for an ozone oxidation treatment method for waste water containing organic contaminants and bacteria. Waste water is injected into a closed tank, submerging fluid-pervious bags containing powdered metal oxide catalyst (manganese trioxide, ferric oxide, nickel oxide or copper oxide); ozone is injected into the bags for exposure to the catalyst and reaction with waste water flowing through the bags. Purified and inert water is drawn from the tank and ozone is vented from the upper part of the tank. (Collins-FIRL)
W77-07094

INTEGRATED APPROACH TO URBAN WASTE WATER MANAGEMENT.
Florida Univ., Gainesville.
S. M. Hasan.
Available from the University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 77-1117. PhD Thesis, 1976, 253 p.

Descriptors: *Water management (Applied), *Urban drainage, *Storm water, *Water quality control, Cost analysis, Flow, Sewage treatment, Cost sharing, Cost allocation, Evaluation, Urban hydrology, Waste water treatment.

Identifiers: N-person cooperative game theory.

An approach was developed for urban waste water management which integrates considerations for urban storm drainage, dry-weather sewage treatment, and wet-weather quality control. There has been a change from 'least-cost' to 'cost-effective' approaches and solutions. This approach presents procedures for formulation of control strategies and their cost evaluation. Integration of these evaluations would take advantage of overlap areas which could combine several functions, and procedures are also presented for this type of evaluation. The question of cost allocation was also considered and methods for cost determinations were presented. Concepts of cost sharing/cost allocation for evaluation of multipurpose plans were reviewed in light of the N-person cooperative game theory. (Collins-FIRL)
W77-07095

FACTORS INFLUENCING THE DEWATERING CHARACTERISTICS OF SLUDGE.
Clemson Univ., S. C.
P. R. Karr, III.
Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 77-652. PhD Thesis, 1976, 245 p.

Descriptors: Analysis, *Dewatering, Physical characteristics, *Sludge treatment, *Particle size, Sludge, Activated sludge, Anaerobic digestion, Biodegradation, Filtration, *Waste water treatment.

Identifiers: Dewatering characteristics, Capillary suction time, Blinding index.

Investigations were conducted to determine factors which influence sludge dewatering characteristics. Raw, activated, and anaerobically digested sludges were studied. Results confirmed that sludge particle size greatly affects dewatering characteristics, measured by specific resistance and capillary suction time (CST). This applied to sludges of all types. Other factors (pH, biological degradation, mixing, and conditioning) affected changes in dewaterability relative to their effects on particle size. Differences in dewatering characteristics were shown to be mainly affected by differences in particle size distributions. Supracoloidal solids in a range of 1 to 100 micrometers most affected dewatering characteristics. Particles of this size range blind sludge cake and filler medium during filtration and result in a large resistance to filtrate flow. A blinding index was developed. (Collins-FIRL)
W77-07097

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

CONCENTRATION AND DETERMINATION OF TRACE ORGANIC POLLUTANTS IN WATER, Iowa State Univ., Ames.

For primary bibliographic entry see Field 5A.
W77-07098

RECYCLING OF ALUMINUM USED FOR PHOSPHATE REMOVAL IN DOMESTIC WASTE WATER TREATMENT, Florida Univ., Gainesville. D. A. Cornwell.

Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 77-140. PhD Thesis, 1975, 225 p.

Descriptors: Aluminum, *Sludge treatment, *Phosphorus, Domestic wastes, Separation techniques, *Phosphates, Coagulation, Extraction, Chemical treatment, Filtration, *Waste water treatment, *Recycling.
Identifiers: *Aluminum recycling, *Phosphate removal.

A process was developed for the economical recovery of aluminum used as a coagulant for phosphorus removal in domestic waste water treatment. Aluminum-phosphate-organic sludge was used. It was thickened to a solids concentration four times that of raw sludge, and reacted with sulfuric acid to dissolve the aluminum and phosphate. Sedimentation produced a 93% separation. The acidified aluminum was separated from the phosphate by a solvent extraction process using a kerosene solution of alkyl phosphates. The aluminum-rich kerosene phase was contacted with 6N H₂SO₄ and the kerosene:acid volume ratio was adjusted to form a final aluminum concentration equal to that in commercial alum (about 5%). Recovered aluminum was reused as a coagulant in phosphorus precipitation and the kerosene was recycled to the extraction stages. Overall recovery of aluminum was 89-93%. (Collins-FIRL)
W77-07099

ON-LINE ADAPTIVE CONTROL FOR COMBINED SEWER SYSTEMS, Colorado State Univ., Fort Collins. P. D. Trotta.

Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No. 77-1188. PhD Thesis, 1976, 224 p.

Descriptors: *Model studies, *Storm water, *Computer models, *Storm runoff, *Combined sewers, Interceptor sewers, Waste water treatment, Overflow, Planning, Automatic control.
Identifiers: Stochastic dynamic programming.

A new approach to the problem of urban storm water management was proposed. On-line computer control of the mechanical features of a combined sewer system was investigated. These controls would aid sewer systems effectively to contain combined flows during storms. A model was developed for a system divided into subbasins. Controls for each subbasin are derived separately using a stochastic dynamic programming formulation. An upper limit for releases is determined by a master control problem, which combines to separate basin situations and determines individual interceptor and treatment capacities. An autoregressive-transfer function model is used to forecast inflows, and can respond to new information on the storm event. A part of the proposed system for San Francisco was used as a test case. Results indicated that controls based on stochastic models were superior to deterministic forecasts. The model provided a superior distribution of overflows when such overflows were unavoidable. A reactive model which was tested was able to minimize total overflows to an even higher degree. (Collins-FIRL)
W77-07100

5E. Ultimate Disposal Of Wastes

PARTICLE CHARACTERISTICS AND DISPERSAL PATTERNS OF SUGAR CANE WASTES IN SELECTED RIVERS AND ESTUARIES OF PUERTO RICO,

Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W77-06632

CHEMICAL QUALITY OF EFFLUENTS AND THEIR INFLUENCE ON WATER QUALITY IN A SHALLOW AQUIFER,

Los Alamos Scientific Lab., N. Mex.
For primary bibliographic entry see Field 5B.
W77-06658

POLLUTANT MOVEMENT TO SHALLOW GROUND WATER TABLES FROM SWINE WASTE LAGOONS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-06742

STUDY OF LEACHATE AT LANDFILL SITES 1975, VOLUME I.

Holzmacher, M. Lendon and Murrell, Melville, N.Y.
For primary bibliographic entry see Field 5B.
W77-06851

WASTE INJECTION INTO STRATIFIED GROUND WATER BODIES,

Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-06855

SEPTIC TANK STUDY IS OFF AND RUNNING.

For primary bibliographic entry see Field 5D.
W77-06859

BURNING WASTE CHLORINATED HYDROCARBONS IN A CEMENT KILN,

St. Lawrence Cement Co., Mississauga, (Ontario). L. P. MacDonald, D. J. Skinner, F. J. Hopton, and G. H. Thomas.
Technology Development Report, EPS 4-WP-77-2, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, March, 1977, 223 p., 31 fig., 66 tab, 28 ref, 9 append.

Descriptors: Burning, *Waste disposal, *Polychlorinated biphenyls, Chlorinated hydrocarbons, Toxicity, Disposal, Cements, Model studies, Persistence, Degradation, Safety, *Waste treatment, *Incineration, Air pollution, Pollutant identification, Canada.
Identifiers: Kilns(Cement).

An experimental program was carried out in 1975/76 at the St. Lawrence Cement Co., in which waste chlorinated hydrocarbons, containing up to about 46 weight percent chlorine, were burned in a rotary cement kiln. The chlorinated hydrocarbons were burned in three distinct phases of increasing difficulty of combustion. Materials burned included mixtures of ethylene dichloride, chlorotoluene and up to approximately 50 percent polychlorinated biphenyls (PCB). These materials were destroyed in the cement kiln with at least 99.98 percent efficiency in all cases. Emissions of high molecular weight chlorinated hydrocarbons were not detected. Three light chlorinated hydrocarbons, dichloromethane, chloroform and carbon tetrachloride, were found in the emissions in the part per billion or lower range. The quantity of precipitator dust requiring disposal, as well as

emissions of particulate matter, increased during the test. The chlorine input from the chlorinated hydrocarbon waste was up to about 0.8 weight percent relative to clinker and this effectively reduced the alkali concentration of the clinker in direct stoichiometric proportion. A reduction in fossil fuels used while burning chlorinated hydrocarbons was noted. (WATDOC)
W77-06946

DRYING POTATO WASTES FOR ANIMAL FEED AS AN ALTERNATIVE DISPOSAL METHOD.

Canadian Bio Resources Consultants Ltd., Surrey (British Columbia).
For primary bibliographic entry see Field 5D.
W77-06947

PROCEEDINGS TECHNOLOGY TRANSFER SEMINAR ON WASTE HANDLING, DISPOSAL AND RECOVERY IN THE METAL FINISHING INDUSTRY, NOVEMBER 12-13, 1975, TORONTO, ONTARIO.

Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
For primary bibliographic entry see Field 5D.
W77-06950

WATER QUALITY MANAGEMENT AND THE DISTRIBUTION OF EMISSION RIGHTS BY SEALED TENDER MARKETS,

Geological Survey, Reston, Va. Water Resources Div.
E. D. Attanasi.
In: North-Holland TMS Studies in the Management Sciences, Vol 3, p 113-123, 1976: North-Holland Publishing Company, New York 1976. 1 fig, 16 ref.

Descriptors: *Water quality control, *Industrial wastes, *Effluents, *Economic efficiency, Economic justification, Evaluation, Cost repayment, Water pollution, Planning.
Identifiers: Decision theory.

Economic analysis of water quality management has primarily dealt with industrial response and consequences of imposing effluent standards or changes on industrial wastes. Several writers have suggested that the River Basin Authority set a level of water quality and utilize simulated auctions to generate data which could be used set effluent charges. However, this paper investigates the possibilities of utilizing sealed tender markets for actual allocation of assimilative capacity through effluent emission rights. The paper analytically models the firm's decision process and response to alternative regulatory policies. It is from this perspective of policy analysis that certain control instruments are shown to result in inferior performance in terms of the potential effects on firm pricing decisions. (Woodard-USGS)
W77-06976

APPARATUS FOR DISPOSAL OF EFFLUENTS.

United States Patent 4,008,155. Issued February 15, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 3, p 935, February, 1977. 1 fig.

Descriptors: *Patents, *Waste disposal, *Separation techniques, Equipment, Surface waters, Pollutants, Water quality control, Water pollution control, Pollutants, Pollution abatement, Flotation.

A patent was issued for an apparatus to handle effluent disposal. The equipment is composed of two major enclosures, one within the other, and has a means for flotation on the open sea. The second chamber includes a centrally located open-bottom chamber. The second enclosure has a closed bottom for the accumulation of material separated from the treated effluent transferred to it from the

first enclosure. The bottom of the second enclosure has tapered chambers arranged side-by-side with walls that diverge upward so that material which is denser than water is separated from the remainder of the waste. (Collins-FIRL)
W77-07002

SUBSURFACE INJECTION—HOW MUCH DOES IT COST.

Black and Veatch, Denver, Colo.
C. P. Houck, and J. L. Smith.
Water and Wastes Engineering, Vol. 14, No. 1, p 35-42, January, 1977. 1 fig, 13 tab.

Descriptors: *Decision making, *Sludge disposal, *Costs, Treatment facilities, Underground waste disposal, Analysis, Planning, Waste water treatment, Sewage disposal, Ultimate disposal, *Injection.

Identifiers: *Subsurface injection, Land applications.

The cost considerations involved in subsurface injection are explored. The decision to use a land application system for sludge disposal may be either dependent or independent of in-plant sludge stabilization and handling costs. Sludge-associated costs are in-plant stabilization costs; transportation costs from plant to disposal site; and costs for subsurface injection. There are various points where these costs may merge. Other factors concerned are land area needs based on sludge quantities which, with plant size, influence costs; land preparation costs; and system hardware costs. Examples were given for calculating costs involved in the decision process. (Collins-FIRL)
W77-07011

ACID SOLUBILIZATION OF SEWAGE SLUDGE AND ASH CONSTITUENTS FOR POSSIBLE RECOVERY.

Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and J. H. Carey.
Water Research, Vol. 10, No. 12, p 1077-1081, 1976. 3 fig, 2 tab, 15 ref.

Descriptors: *Heavy metals, *Activated sludge, *Acids, *Sludge disposal, *Sludge digestion, Sludge treatment, Treatment facilities, Leachates, Resources, Incineration, Waste water treatment, Sewage disposal, Temperature, *Sewage sludge, Solubility.

Identifiers: *Acid solubilization.

The disposal of sludge incineration matter has posed a potential hazard, since its ash contains some heavy metals which are leachable. An investigation was done to determine the possibility of using acid solubilization of sludge and ash constituents to reduce the problem. Digested sludge samples were collected from eight southern Ontario activated sludge treatment facilities. A procedure was adopted, based on data from the samples, for acid extraction of sludges. H₂SO₄ or HCl was added to lower sludge pH to 1.5, and solids were then separated from the leachate by vacuum filtration. The residue was rinsed with an equal volume of water to restore a normal pH and the solids could be disposed on agricultural land. Leachate can be processed for recovery of valuable components. Testing revealed that toxic trace metals recovery from wet sludges does not seem economically viable. Other studies showed that soil bacteria, especially under aerobic conditions, release high percentages of heavy metals in digested sludge when applied to agricultural land. Removal and recovery of metals and phosphates from sludge incinerator ash was not proven economically attractive. Investigations on the effect of incineration parameters on leachability of ash components is needed because temperature in this process has a great effect on leachability of ash metals. (Collins-FIRL)
W77-07017

FLUOSOLIDS INCINERATOR COMMISSIONED AT ESHER.

Water Services, Vol. 80, No. 970, p 753-754, December, 1976.

Descriptors: *Treatment facilities, *Incineration, *Sludge disposal, Sludge treatment, Solid wastes, Ultimate disposal, Sedimentation, Filters, Biological treatment, Dewatering, Lime, Oxygen, Gases, *Waste treatment, Organic matter.

Identifiers: Copperas, Sulfur dioxide, *Fluosolids.

Operational aspects of the fluosolids incinerator at Esher, England, were reviewed. The plant was designed to cope with the ultimate disposal of sludge residue from treatment plants by employing incineration. The process includes a mechanically raked screen, detritor, primary sedimentation, biological filters, humus tanks, microstrainers, and sludge incineration. After thickening, conditioning by lime and copperas, and dewatering by coifilters, the coifilter sludge cake is fed to the fluosolids system for incineration. The sludge cake is mixed within the hot sand bed to evaporate the water content and the organic components react with oxygen in the fluidizing air to achieve complete combustion with a minimum of excess oxygen at minimum temperatures. Exit gases pass through a heat exchanger and then to a venturi scrubber with a multitray cooling section. This removes solids/particulate matter from the gas stream and adds alkali for maximum SO₂ removal. Water droplets with particulate solids are removed from the gas stream in a vane separator. The fluosolids reactor operates at a temperature of 620 C. Minimal heat losses from the refractory lined shell and the heat reservoir of the sand bed allow a short reheating time after shut down periods. The incinerators can be shut down instantly without harm or a need for quench water or cooling air maintenance. The reactor has no moving parts. (Collins-FIRL)
W77-07018

SLUDGE INCINERATION AT ESHER.

Effluent and Water Treatment Journal, Vol. 16, No. 11, p 559-560, November, 1976.

Descriptors: *Incinerators, *Treatment facilities, *Sludge treatment, Equipment, Costs, Water utilization, Evaluation, Performance, Water reuse, *Waste treatment.

Identifiers: Esher(England).

A new Fluosolids sludge incineration plant has become operational in Esher, England. The plant, now serving a population of 70,560 with a treatment capacity of 1,000 kg/hour, is capable of handling 200,000/hour, if necessary. There is no odor with this method and the sludge is reduced to a fine inert ash. After thickening, the sludge is treated with lime and copperas and transferred to coil filters for dewatering. A sludge cake is formed which can be discharged for transportation or fed into a three section reactor for incineration. Interlocking fail safe systems are provided. (Collins-FIRL)
W77-07020

ACCUMULATION OF HEAVY METALS IN SOILS FROM EXTENDED WASTE WATER IRRIGATION.

Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-07049

PERSISTENCE OF POLIOVIRUS 1 IN SOIL AND ON VEGETABLES GROWN IN SOIL PREVIOUSLY FLOODED WITH INOCULATED SEWAGE SLUDGE OR EFFLUENT.

Food and Drug Administration, Cincinnati, Ohio. Virology Branch.
For primary bibliographic entry see Field 5C.
W77-07050

AGRICULTURAL DISPOSAL OF AEROBIC WASTEWATER SLUDGES IN AN URBAN COUNTY.

Clermont County Water and Sewer District, Batavia, Ohio.
For primary bibliographic entry see Field 5D.
W77-07057

CONDITIONING AND LAND APPLICATION OF AEROBICALLY DIGESTED SLUDGE.

Montgomery County Sanitary Dept., Dayton, Ohio.
For primary bibliographic entry see Field 5D.
W77-07058

LAND APPLICATION OF SEWAGE SLUDGE: IV. WHEAT GROWTH, N CONTENT, N FERTILIZER VALUE, AND N USE EFFICIENCY AS INFLUENCED BY SEWAGE SLUDGE AND WOOD WASTE MIXTURES.

Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5D.
W77-07079

APPLICATION OF MUNICIPAL REFUSE AND LIQUID SEWAGE SLUDGE TO AGRICULTURAL LAND: II. LYSIMETER STUDY.

North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5D.
W77-07080

TRENDS IN SLUDGE TREATMENT AND DISPOSAL PRACTICES IN THE UNITED STATES.

Municipal Environmental Research Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5D.
W77-07083

COMPOSTING OF SEWAGE SLUDGE AND SOLID WASTE MATTER.

Department of Waste Water Technology and Sludge Disposal, Warsaw (Poland). Local Economy and Environment Protection.
For primary bibliographic entry see Field 5D.
W77-07084

5F. Water Treatment and Quality Alteration

THE REMOVAL OF ORGANIC MATTER FROM WATER SUPPLIES BY ION EXCHANGE.

Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
C. Anderson, and J. Maier.
Available from the National Technical Information Center, Springfield, VA 22161 as PB-266 022. Price Code: A04 in paper copy, A01 in microfiche. Minnesota Water Resources Research Center, Bulletin No. 91, University of Minnesota, Feb. 1977. 49 p, 16 fig, 16 tab, 38 ref. OWRT A-030-Minn(3).

Descriptors: *Organic matter, Pollutants, *Water pollution treatment, Carbon, *Anion exchange, *Waste water treatment, *Water treatment, Treatment facilities, Potable water, Design criteria, Resins.

This study was initiated to provide quantitative information on the use of anion exchange resins for organic removal. The organics that are present in surface water waters which currently pass through conventional treatment could be removed by anion exchange with the use of strongly basic anion exchange columns. The organics were removed to the lower limits of detection of the total organic carbon analysis with the use of the high porosity

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

strongly basic resins. These resins were also easily regenerated with the use of sodium chloride. The selectivity and kinetics of the chloride versus organic exchange process was briefly investigated. The reason being that this is a new approach to this problem and no data was available in the literature to provide information which could be used for preliminary design of a full scale treatment plant. A preliminary plant design showed that the process would be economically feasible and competitive with alternate methods of organic removal, assuming that they would also be as effective at organic removal as ion exchange. So, ion exchange could prove to be an effective, reliable and economical method to provide for the removal of organics for drinking water. (Waelti-Minnesota) W77-06760

HEALTH EFFECTS OF MULTIPURPOSE USE OF WATER.
Stockholm Univ. (Sweden). Wallenberg Lab.
For primary bibliographic entry see Field 5C.
W77-06775

ENERGY CONSERVATION AND HEAT RECOVERY IN WASTE WATER TREATMENT PLANTS.
Pirnie (Malcolm), Inc., White Plains, N. Y.
For primary bibliographic entry see Field 5D.
W77-07024

ON THE SELF-PURIFICATION OF NATURAL WATERS, (IN GERMAN).
Limnologische Station Niederrhein in der Max-Planck-Gesellschaft z.F.d.W., Krefeld (West Germany).
For primary bibliographic entry see Field 5G.
W77-07038

DESIGN CRITERIA FOR WASTE WATER AERATOR DRIVES.
For primary bibliographic entry see Field 5D.
W77-07060

PURIFYING WATER.
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
For primary bibliographic entry see Field 5D.
W77-07061

5G. Water Quality Control

THE GROWTH SHAPERS: THE LAND USE IMPACTS OF INFRASTRUCTURE INVESTMENTS.
Urban Systems Research and Engineering, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 6D.
W77-06601

MIXING AND CIRCULATION OF LAKES AND RESERVOIRS WITH AIR PLUMES.
New Hampshire Univ. Durham. Dept. of Chemical Engineering.
R. S. Torrest, and J. Wen.
Available from the National Technical Information Service, Springfield, VA as PB-265 909. Price codes: A07 in paper copy, A01 in microfiche. New Hampshire Water Resources Research Center, Durham, Research Report No. 13, (1976). 128 p, 2 tab, 51 fig, 92 ref, append. OWRT A-030-NH(2).

Descriptors: *Self purification, Absorption, Domestic water, Stratification, *Aeration, *Mixing, *Circulation, Eutrophication, Lakes, Reservoirs, Velocity profiles, *Dissolved oxygen, Mass transfer, Design, Currents (Water), Model studies.
Identifiers: *Air plumes, Surface currents.

Aeration of lakes and reservoirs to control eutrophication and improve water quality is widespread. However, there are few guidelines to aid in design of the aeration treatment. Here relevant fluid mechanics literature is first summarized to show that the nature of the flow of water entrained by air bubbles rising from manifolds and point sources may be well described. Experimental studies of the resulting surface flows supplement and extend previous work. Surface velocity decay is described and, for manifold ration, the circulation cell size is shown to be about four times the water depth on each side of the manifold. Detailed measurements of velocity profiles are presented for a wide range of aeration rates in channels to 1 1/2 feet wide, 4 feet high and 12 feet long. The influence of aerator design and depth is illustrated, as is the variation of circulation efficiency with aeration rate. Similar results for 'point source' aeration to 9 scfm are described. Circulation due to water injection from a manifold (i.e., jet injection) is compared with that due to aeration. Measurements of the time variation of dissolved oxygen within the primary circulation are well described by a simple mathematical model with the single parameter, the time constant, a function of aeration rate. These results should aid in the overall design of aeration treatments since the characteristics of aeration induced circulation and the resulting dissolved oxygen variation can be estimated for systems of interest.
W77-06633

AN EXECUTIVE SUMMARY OF THREE EPA DEMONSTRATION PROGRAMS IN EROSION AND SEDIMENT CONTROL.
Hittman Associates, Inc., Columbia, Md.
B. C. Becker, M. A. Nawrocki, and G. M. Sitek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-239 333. Price codes: MF A01 in microfiche. Environmental Protection Agency Report No. EPA-660/2-74-073, Washington, D.C., June 1974. 58 p, 7 fig, 1 tab, 2 ref. EPA 68-01-0743.

Descriptors: *Maryland, *Erosion control, *Sedimentation, *Storm water, *Demonstration watersheds, Aquatic environment, Construction, Rainfall-runoff relationships, Urbanization, Watersheds (Basins), Dredging, Sediment deposition, Filtering systems, Separation techniques, Biology, Channel morphology, Retention, Ponds.
Identifiers: Guidelines, Suspended solids separation, Pond dredging, Grade control.

This report presented the highlights of three recently completed programs in the area of sediment and erosion control. These programs were a 'Joint Construction Sediment Control Project,' a 'Programmed Demonstration for Erosion and Sediment Control Specialists,' and a 'Demonstration of the Separation and Disposal of Concentrated Sediments.' The first program demonstrated and developed guidelines for erosion and sediment control in urbanizing areas; the second program produced a series of 15 presentations on sediment and erosion control; and the third program consisted of a field demonstration of a system for removing and processing sediments from pond bottoms. (Visocky-ISWS)
W77-06671

DEBRIS BASINS FOR CONTROL OF SURFACE MINE SEDIMENTATION.
Kentucky Dept. for Natural Resources and Conservation, Frankfort. Office of Planning and Research.
L. R. Kimball.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 959. Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report No. EPA-600/2-76-108, Cincinnati, Ohio, June 1976. 58 p, 13 fig, 11 tab, 7 ref, 1 append. EPA S801276.

Descriptors: *Sediment control, *Coal mine wastes, *Drainage, *Erosion control, *Kentucky, Feasibility studies, Demonstration watersheds, Sampling, Monitoring, Soils, Slopes, Water quality, Streamflow, Sedimentation.
Identifiers: *Surface mining, *Debris basins, Sediment ponds, Steep slope mining, Total solids.

This study reported on the feasibility of demonstrating the effectiveness of debris basins in controlling solids in water discharging from surface mine operations. Two sites in Eastern Kentucky were selected for study in areas where very little erosion-causing activity has occurred, and where surface mining is to be initiated. Adjacent 'virgin' watersheds were also selected for each study site to provide background data on water quality where man's activities have been very limited. Pertinent site information, including flow and water quality data, was gathered. This study indicated the necessity for conducting the demonstration and develops a recommended procedure. (Visocky-ISWS)
W77-06672

MEANS FOR PROTECTING THE DRINKING WATER QUALITY OF LAKE GEORGE, NEW YORK.
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
D. B. Aulenbach, and N. L. Clesceri.
Rensselaer Polytechnic Institute FWI Report 77-1, March 1977. 31 p., 5 fig., 3 tab., 28 ref.

Descriptors: *Water quality control, *Potable water, *Lakes, *Water pollution control, *New York, Sewage treatment, Recreation.
Identifiers: *Lake George (NY), Nutrient sources.

Homeowners around Lake George in the eastern Adirondack Mountains of New York State drink water directly from the lake with no treatment other than chlorination as required by state law. There are no restrictions on swimming, fishing, or boating other than those prohibiting waste discharges from boats. Probably the most important factor in maintaining the high quality of the waters is the lake's morphology. The narrow and deep lake has high ratio of hypolimnion-to-epilimnion which helps maintain oligotrophic conditions. Another significant factor is the relatively small drainage basin, approximately four times the total surface area of the lake. The low nutrient content of the surface soil and bed rock, and the probable uptake of nutrients by the forested areas help control nutrient inputs from tributary streams. In addition, there is active concern among all the users of the lake, both private and commercial. Phosphorus inputs have been eliminated by treatment plants which provide the equivalent of tertiary treatment to the two dense population centers; about 6% of the nitrogen entering the lake originates from the treatment plants' effluents. Habitations not readily accessible to sewers are served by septic tanks which are stringently monitored. (Auen-Wisconsin).
W77-06682

NUTRIENT REMOVAL AND SLUDGE DISPOSAL WITHIN SEPTIC SYSTEMS-PHASE III.
Rensselaer Polytechnic Inst., Troy, N. Y. Fresh Water Inst.
For primary bibliographic entry see Field 5D.
W77-06686

LAKE RESTORATION BY BOTTOM WATER SIPHONING (IN GERMAN).
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland). Marine Research Lab.
R. Cachter.
Hydrologie, Vol. 38, No. 1, p. 1-27, 1976. 9 fig., 5 tab., 23 ref.

Descriptors: *Siphons, *Nutrient removal, Phosphorus, Nitrogen, Trophic level, Eutrophication, Cycling nutrients, Hypolimnion, Sediments, Nitrogen cycle, Lakes.
Identifiers: *Lake restoration, Maunsee(Switzerland), Phosphorus loading.

The effects of an artificially increased nutrient export, using a hypolimnion siphon, on the trophic state of Maunsee, a relatively small, shallow, highly eutrophic lake in central Switzerland were investigated. It was concluded that: (1) It is possible to influence a shallow lake's trophic character by siphoning off part of its bottom water; (2) phosphorus became accumulated in the very top layer of sediments due to the yearly alternation of anoxic phosphorus release and aerobic phosphorus fixation; (3) the lake's internal phosphorus cycle accelerated as more and more phosphorus became available in the top layer of sediments causing a self-maintaining autotrophication of a lake as soon as the external nutrient loading reached a level favoring transiently anoxic conditions; (4) the lake's internal phosphorus loading of the trophogenic layer by sediments temporarily exceeded the external loading by more than a hundred-fold; (5) during the summer stagnation period, the phosphorus export exceeded the external supply even without siphon; (6) the same was true for nitrogen during fall and winter overturn; (7) drastically increased nutrient export caused a nutrient reduction in the top sediment layer which decreased the back diffusion rate from the sediments to water; (8) siphoning will decrease primary production as long as the nutrient supply to the trophogenic layer is the rate limiting factor; and (9) siphoning led to an improvement of oxygen conditions in the hypolimnion. (Luedtke-Wisconsin)
W77-06689

THE GENERATION OF RESIDUAL FLOWS IN NORWAY: AN INPUT-OUTPUT APPROACH,
Oslo Univ. (Norway). Inst. of Economics.
F. R. Forsund, and S. Strom.
Journal of Environmental Economics and Management, Vol. 3, No. 2, p. 129-141, 1976. 6 tab., 17 ref.

Descriptors: *Pollution abatement, *Input-output analysis, *Effluents, Economics, Foreign countries, Gross national product, National income, Consumptive use, Industries, Industrial wastes, Pulp and paper industry, Metals.
Identifiers: *Norway, Residuals.

Input-output analysis is used to study the generation of 35 different kinds of residuals for the Norwegian economy in 1970, where these residuals are treated as the joint products in consumption and production and the discharge to the air, land and water. The residuals are mercury, lead, cadmium, zinc, copper, iron, chrome, sulfur oxides, hydrochloric acid, nitrogen oxides, other acids, soda lye, other bases, fluorine, cyanide, arsenic, carbon monoxide, phosphorus compounds, nitrogen compounds, mine tailings/inorganic sludge/dust, pesticides, aliphatic halogenated hydrocarbons, bark, fiber, wood chips, plastic substances, dissolved biologically-decomposable organic substance, suspended biologically-decomposable substance, oil and oil products, dispersing agents, taste and smell-producing substances, substances with acute poisonous effects, organic solvents, other organic substances, and unspecified waste. Categories of final demand for each residual are enumerated for total export, government consumption, total gross fixed asset formation and total private consumption. A method is also derived for computing the cost of reducing discharges for each of the 35 residuals, given in cost coefficients for total supply per ton reduction of discharge. In the Norwegian 1970 economy, export, and especially export from the pulp and paper and metals and minerals sectors, was the main contributor of the flow of residuals. (Harris-Wisconsin)
W77-06698

ADJUSTMENT COSTS AND OPTIMAL WASTE TREATMENT,
State Univ. of New York at Albany. Dept. of Economics.
For primary bibliographic entry see Field 5D.
W77-06699

POLLUTERS' PROFITS AND POLITICAL RESPONSE: DIRECT CONTROL VERSUS TAXES: COMMENTS AND REPLY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for the Study of Public Choice.
J. M. Buchanan, and G. Tullock.
American Economic Review, Vol. 66, No. 5, p. 976-984, 1976. 8 ref.

Descriptors: *Pollution taxes(Charges), *Water pollution control, *Political constraints, Profit, Economics, Return(Monetary), Institutional constraints, Income.
Identifiers: *Pollution licenses.

Three reviews by environmental economists take issue with arguments raised in an earlier study which examined the political processes that led to the formulation of roles and regulations rather than taxes in the control of pollution. Whereas the original study postulated that because of regulation firms would be less than optimum size, one author argues that the regulated firms would be greater than optimum size and presents an analysis that shows firms engaging in transactions which increase profitability; this is in contrast to the earlier argument that firms are constrained to a less-than-maximum profits equilibrium. A second review claims that the explanation for the revealed preference of transactors for (equitable) direct controls (equal quotas of pollution production) lies in the probability that firms value the returns from taxes at less than the dollar amounts of paid taxes. A third review raises questions of methodology in regard to pollution control alternatives. The authors of the original study reply to the three reviewers, arguing that a quota scheme of pollution control, while not necessarily an efficient way to compensate for the problem, may represent the best politically viable alternative. (Harris-Wisconsin)
W77-06700

EFFLUENT CHARGES AND POLLUTION CONTROL: A CASE STUDY,
Royal Military Coll. of Canada, Kingston (Ontario). Dept. of Political and Economic Science.
G. Lepore.
Canadian Public Policy, Vol. II, No. 3, p. 482-491, 1976. 4 tab., 8 ref.

Descriptors: *Pollution taxes(Charges), *Water pollution control, Canada, Sulfur compounds, Estimation, Unit costs, Economics, Costs, Air pollution.

A study of the effects of pollution taxes as an instrument of environmental control argues that, aside from any other relevant considerations, a policy aimed at controlling pollution through such charges necessitates a prior knowledge of the approximate magnitude of the charges required. The study also proposes a method to estimate such magnitude, based on the derivation of cost curves of abatement for given pollutants. The estimation method assumes that many types of sources discharge any one pollutant and that the known cost of abatement per unit of pollutant is likely to be different for different sources. Therefore, by plotting cost per unit of pollutant abated against the overall reduction of pollutants, a cost function is obtained which can be used in the same manner as a true overall additional cost function. In fact, since estimates of costs usually come in the form of ranges, the result also will be an estimated range of maximum and minimum costs. The procedure was followed to estimate the minimum and maximum reduction of emissions of sulfur oxides by

ten types of sources in nine industries. These industries are the source of about 75% of all emissions of sulfur oxides in Canada. (Harris-Wisconsin)
W77-06701

OPTIMAL OIL TANKER SIZE WITH REGARD TO ENVIRONMENTAL IMPACT OF OIL SPILLS,
California Univ., Los Angeles. Graduate School of Management.
R. K. Sarin, and C. R. Scherer.
Journal of Environmental Economics and Management, Vol. 3, No. 3, p. 226-235, 1976. 3 fig., 15 ref.

Descriptors: *Oil spills, Ships, *Environmental effects, *Model studies, *Optimization, Size, Water pollution sources, Oil industry, Navigation, Law of the sea, Accidents, Hazards, Harbors, Estimating scheduling, Economics, Pacific Ocean, Alaska.
Identifiers: *Oil tankers, Tradeoffs.

A model is examined which offers a probabilistic framework for investigating oil tanker size with regard to expected environmental impact of spills during accidental incidences along a coastal shipping route. The model was designed in anticipation of problems involving supertankers moving oil from Valdez, Alaska to west coast ports in the lower states. The model specifically examines tradeoffs between the local environmental impact of relatively small but frequent oil spills associated with the traffic of many small tankers, and the local environmental impact of large and relatively infrequent spills with fewer tankers of larger size. Important relationships between tanker size, traffic density, number of accidents and spills and environmental impact are outlined and defined. A procedure is suggested to incorporate the environmental impact of oil spills in the model without quantifying them in monetary units. A closed-form solution set for optimal tanker size is obtained and some numerical results are presented. Within the model, separate expressions are developed to account for damages from three kinds of sources: (1) collision of a loaded tanker with another tanker or any other ship on the route or in harbor areas; (2) casualties enroute other than collision, e.g., grounding, fire, or structural failure of the loaded tanker; and (3) accidental releases during loading and unloading in port. (Harris-Wisconsin)
W77-06702

REGULATING ACTIVITIES WITH CATASTROPHIC ENVIRONMENTAL EFFECTS,
California Univ., Riverside. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06703

UNCERTAINTY AND THE CHOICE OF POLLUTION CONTROL INSTRUMENTS,
Tel Aviv Univ. (Israel). Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06704

OPTIMAL INVESTMENT IN POLLUTION CONTROL CAPITAL IN A NEOCLASSICAL GROWTH CONTEXT,
Pittsburgh Univ., Pa. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06705

AN INPUT-OUTPUT ANALYSIS OF ENVIRONMENTAL PRESERVATION,
Manitoba Univ., Winnipeg. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06706

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

TWO-GOAL REGIONAL ENVIRONMENTAL POLICY: THE CASE OF THE SANTA ANA RIVER BASIN.
Tel-Aviv Univ. (Israel). Dept. of Economics.
E. Hochman, D. Zilberman, and R. E. Just.
Journal of Environmental Economics and Management, Vol 4, No 1, p 25-39, March 1977. 7 fig, 1 tab, 11 ref, append.

Descriptors: *Water pollution control, *River basins, *Water policy, *Dairy industry, *Environmental control, Reservoirs, Local governments, *Regional development, Decision making, Standards, Efficiencies, Economics, Equations, Mathematical models, Operations research, California, *Regional analysis.
Identifiers: *Santa Ana River basin(Calif), Production, Aggregation, Conflicting goals, Los Angeles(Cal), Welfare function maximization.

In determining public policy measures, the value of information about the functional relationships between targets and instruments can hardly be understated. In this paper, these macrorelations are obtained for a competitive industry by way of aggregation over many individual firms following simple behavioristic patterns. With the exact knowledge of the macrorelations, obtaining the numerical values of the instruments becomes a simple mathematical programming problem. These principles are applied in examination of the water pollution problems generated by the dairy industry in the Santa Ana River basin where local governments face the problem of controlling environmental quality with minimum opportunity costs in terms of output. Assuming the two conflicting goals—production level and environmental quality—and two policy instruments—regulation of waste disposal technologies and level of guaranteed credit to finance antipollution investments, a model is constructed to identify the impact of these controls on the individual microunits (firms). The microimpacts are then aggregated across firms to generate a tradeoff relationship at the macrolevel between production and environmental quality goals and to determine the relationship between each of the macrogoals and the two policy instruments. Thus, the regional policymaker can determine levels of the policy variables which will maximize a regional welfare function subject to the appropriate technological and financial constraints. Results indicate that a more efficient and flexible policy can maintain higher environmental quality while causing fewer firms to relocate. (Bell-Cornell)
W77-06707

WATER CHEMISTRY AND WATER QUALITY.
Uppsala Univ. (Sweden). Dept. of Physical Geography; and Uppsala Univ. (Sweden). Div. of Hydrology.
For primary bibliographic entry see Field 5A.
W77-06778

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 2: FISH, PLANKTON, BENTHOS, LITTORAL.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
For primary bibliographic entry see Field 6G.
W77-06825

STUDY OF LEACHATE AT LANDFILL SITES 1975, VOLUME 1.
Holzmacher, McLendon and Murrell, Melville, N.Y.
For primary bibliographic entry see Field 5B.
W77-06851

USGS SCIENTISTS BRING CALIFORNIA WATER SUPPLY INTO COMPLIANCE WITH FEDERAL REGULATIONS.
Geological Survey, Laguna Niguel, Calif.
L. A. Eccles, J. M. Klein, and W. F. Hardt.
Water Well Journal, Vol. 31, No. 2, p 42-45, February, 1977. 3 fig.

Descriptors: *Nitrates, *Pollution abatement, Aquifers, Fertilizers, Water pollution sources, Well screens, Water wells, *California, Water quality standards.
Identifiers: *Redlands(Calif), *San Bernardino(Calif).

In January 1976, ground water investigators of the U.S. Geological Survey began working on a solution to a high nitrate problem in the Redlands, California (San Bernardino Valley) area where wells were yielding samples double the Safe Drinking Water Act recommendations of 10 mg/l. Many years of citrus growing and concomitant use of nitrogen fertilizer had contaminated the upper of two significant water-producing zones separated by a sandy-clay interval. The primary well under investigation was screened in both zones with the pump located in the upper, and produced water with nitrate-nitrogen concentration up to 20 mg/l. By installing an inflatable packer at the bottom of the contaminated zone and resetting the pump at greater depth, the nitrate-nitrogen concentration was reduced to a constant 4 mg/l with only a 25 percent decrease in well yield. Permanent sealing of perforations in the upper zone was recommended to maintain high-yield low nitrate performance of this well. Long-term pollution abatement practices suggested for this area include minimization of downward flow of water in the aquifer, avoidance of indiscriminate perforation of wells in all water bearing zones penetrated, and pumping several wells at lower rates rather than a single well at maximum rate. (Eberle-NWWA)
W77-06853

POLLUTION PREVENTION, NOT CONTROL CALLED KEY TO A CLEAN ENVIRONMENT.
Water Conditioning, Vol 18, No 11, p 9, January, 1977.

Descriptors: *Pollution abatement, *Water pollution, *Air pollution, Taxes, Costs, United Nations, Legislation.
Identifiers: *Pollution source control, Pollution control technology, Tax incentives.

A conservation approach to industrial pollution which stresses prevention over cure has been outlined during an environmental program of the United Nations' Economic Commission for Europe. In view of the escalating costs of pollution removal, the only economic alternative may be the design of processes and products which yield little or no contaminants to air or water. The 3M Company, of St. Paul, Minnesota has initiated such a program and in the nine months of its operation has eliminated waste at an annual rate of 70,000 tons of air pollutants and 500 million gallons of waste water. At the present time this type of pollution control has not received recognition by governments or the general public. Consequently emphasis has been placed on the traditional removal type of pollution control technology. Tax incentives which provide for the traditional removal techniques do not serve the source control methods. Some regulations limit the percentage rather than the total amount of pollutants, this prohibits using techniques that reduce the amount of pollutants even though they increase the concentration. Problems of this nature can be reduced only if the technical aspects of pollution control can be recognized by governments as much as the legal and political aspects. (Heiss-NWWA)
W77-06861

THE LEGAL RESPONSIBILITY OF WATER WELL DRILLERS.
National Water Well Association, Worthington, Ohio.
H. W. Weiss.
Water Well Journal, Vol 31, No 2, p 39-40, February, 1977.

Descriptors: *Water pollution control, *Well regulations, Sewage bacteria, Water law, Water wells, Drilling, Legal aspects.
Identifiers: *Well construction, *Well contractor liability.

Recent hydrological developments making possible the accurate location of sources of ground water pollution, in addition to increased public awareness of water resource conservation and water rights, are placing today's well contractor in new positions of liability for contamination. If faulty casing or grouting procedures result in contamination from sewage bacteria or other chemical sources, the contractor may be liable to (1) the well owner (2) the owners of adjacent property whose wells have been contaminated due to the defective well, and (3) a state or local agency whose well construction regulations have been violated. Many perplexing questions concerning liability exist, e.g., responsibility for contamination in the event of a surface spill over a shallow aquifer, negligence of a well owner or housing developer, the reasonable length of time a well should provide trouble-free service, etc. Until such issues are resolved, the contractor's strict adherence to local codes and the use of approved materials is strongly recommended. (Eberle-NWWA)
W77-06862

NEW DESIGN GIVES DENVER DISTRICT IRON-FREE WELL.
Wright Water Engineers, Inc., Denver, Colo.
For primary bibliographic entry see Field 8A.
W77-06868

HOW TO DEAL WITH PITTING AND CORROSION.
For primary bibliographic entry see Field 8G.
W77-06869

THE NEW YORK BIGHT PROJECT - 1975; STONY BROOK, LONG ISLAND, NEW YORK.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
NOAA Special Report, March 1976. 29 p, 2 fig, 1 tab, 63 ref, 3 append.

Descriptors: *Baseline studies, *Resources development, Water resources, *Water quality control, *Environmental effects, Management, Planning, Monitoring, Oceanography.
Identifiers: *New York Bight, Research projects, Environmental surveys, Oceanographic data.

The objective of the Marine Ecosystems Analysis (MESA) Program is to identify and measure the impact of man on the marine environment. This requires that we: (1) describe, understand, and monitor physical, geological, chemical, and biological processes of marine environmental systems in territorial, boundary, and international waters around the United States; (2) analyze impacts of natural phenomena or manmade alterations on marine environments; and (3) provide information and specialized support for the effective management of marine areas and for the rational use of their resources. (NOAA)
W77-06876

PROGRAM DEVELOPMENT PLAN. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
National Oceanic and Atmospheric Administration, Washington, D.C.

For primary bibliographic entry see Field 6G.
W77-06878

LOSS OF 2,4-D IN RUNOFF FROM PLOTS RECEIVING SIMULATED RAINFALL AND FROM A SMALL AGRICULTURAL WATERSHED,
Southern Piedmont Conservation Research Center, Watkinsville, Ga.
For primary bibliographic entry see Field 5B.
W77-06908

DISPERSION OF LIQUID WASTE FROM A MOVING BARGE,
Alabama Univ., Tuscaloosa.
For primary bibliographic entry see Field 5B.
W77-06913

OPEN SPACE AND URBAN WATER MANAGEMENT - PHASE II: CASE STUDIES AND FINDINGS,
North Carolina Univ. at Chapel. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6B.
W77-06917

EVALUATION OF ALTERNATIVE SOLUTIONS TO GAS BUBBLE DISEASE MORTALITY OF MENHADEN AT PILGRIM NUCLEAR POWER STATION,
Yankee Atomic Electric Co., Westboro, Mass.
R. A. Marcello, Jr., M. H. Krabach, and S. F. Bartlett.
Report YAEC-1087, October, 1975. 127 p, 44 fig, 139 ref.

Descriptors: Animal physiology, Fish diseases, Bioassay, *Supersaturation, Stress, *Fish behavior, *Pathology, *Power plants, *Power operations and maintenance, Mortality, Cooling water, Engineering structures, *Thermal power, Thermal pollution, Thermal power plants, *Fish barriers, Fish repellent, Nuclear power plants, *Massachusetts.
Identifiers: *Menhaden, Bubbler system, *Submerged offshore diffuser, *Degassing techniques, Effluent dilution, Plant operating restrictions, *Pilgrim Nuclear Power Station(Mass).

The objective is to determine the feasibility and potential application of various fish diversion and deterrent techniques and power plant operational and discharge design modifications which would prevent or minimize the occurrence of gas bubble disease mortalities of menhaden at Pilgrim Nuclear Power Station. The specific alternatives considered in this report include: behavioral barriers, physical barriers, high current velocity barriers, a submerged offshore diffuser, degassing techniques, effluent dilution, plant operating restrictions, and the commercial harvest of menhaden. These alternatives were evaluated on the basis of the following criteria: system effectiveness, system cost, operating experience, design development requirements, applicability in discharge canal or thermal plume, regulatory acceptability, and potential environmental impacts (other than effects on adult menhaden). (Katz)
W77-06928

MISSISSIPPI SOUND TEMPORAL AND SPATIAL DISTRIBUTION OF NUTRIENTS,
Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss. Gulf Coast Research Lab.
For primary bibliographic entry see Field 5B.
W77-06932

ALGAL SUPPLEMENT ENHANCEMENT OF STATIC AND RECIRCULATING SYSTEM,
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Research Inst.

For primary bibliographic entry see Field 5C.
W77-06933

STATE INFORMATION NEEDS RELATED TO ONSHORE AND NEARSHORE EFFECTS OF OCS PETROLEUM DEVELOPMENT,
For primary bibliographic entry see Field 6G.
W77-06934

WHO'S MINDING THE SHORE. A CITIZENS' GUIDE TO COASTAL MANAGEMENT,
Natural Resources Defense Council, Inc., Palo Alto, Calif.
Report to NOAA, Office of Coastal Zone Management, August 1976. 56 p, 4 append.

Descriptors: *Planning, *Ecosystems, *Oil pollution, *Resources development, *Baseline studies, *Environmental effects, Land use, Coasts, Shore protection, Public rights.
Identifiers: *Coastal Zone Management, Public interest.

This handbook is designed to help citizens participate in their state's planning effort. The CZMA is described and states requirements are listed. A catalog of what people can do to become actively involved in the formulation of their state's program is given. The requirements an effective program must meet are considered and the natural forces at work in the coastal ecosystems and the areas which are vital to the preservation of these ecosystems are outlined. The various recreational, commercial, and industrial activities which compete for use of the coastal zone are described and some of the considerations which should be taken into account for their proper management are given. Two of the most acute development pressures in the coastal zone--offshore oil production and residential subdivisions--are considered with their problems for the design of a management program. Finally, an analysis of the rights of public and private owners of property in the coastal zone and the extent of state authority to regulate their use of property in the management program is given. (NOAA)
W77-06935

COASTAL FACILITY GUIDELINES: A METHODOLOGY FOR DEVELOPMENT WITH ENVIRONMENTAL CASE STUDIES ON MARINAS AND POWER PLANTS,
National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
For primary bibliographic entry see Field 6G.
W77-06936

COASTAL ZONE MANAGEMENT, ANNOTATED BIBLIOGRAPHY,
National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
For primary bibliographic entry see Field 2L.
W77-06937

ENVIRONMENTAL POLLUTION: IS THERE ENOUGH PUBLIC CONCERN TO LEAD TO ACTION,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 6G.
W77-06955

REVIEW AND ANALYSIS OF HYDROGEOLOGIC CONDITIONS NEAR THE SITE OF A POTENTIAL NUCLEAR-WASTE REPOSITORY, EDDY AND LEA COUNTIES, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-06974

CINCINNATI'S PREVENTIVE MAINTENANCE SEWER PROGRAM.
Water and Sewage Works, Vol. 124, No. 1, p 70-71, January, 1977.

Descriptors: *Sewerage, *Repairing, *Inspection, *Cleaning, *Maintenance, *Water districts, Cities, Personnel, Water quality control, Sanitary engineering, *Ohio.
Identifiers: *Cincinnati Metropolitan Sewer District(OH).

The Greater Cincinnati Sewer Maintenance Division will soon complete a 12-year program of preventive inspection and cleaning of its 4000-mile sewer system. The goal of the project is to provide repair and cleaning services before conditions warrant complaints. A complex network of crews was formed to achieve this goal. There are three cleaning and repair-section crews and an inspection section crew. Each cleaning/repair section has two major repair crews, a minor repair crew, two major cleaning crews, a power cleaning crew, and a complaint crew. The inspection and investigation section is composed of three minor investigation crews for interceptor cleaning; three regulator crews--two routine inspection crews and one maintenance crew for welding and fabrication; and four routine inspection crews. Other divisions of the Metropolitan Sewer District are Administration, Technical Services, and Operations. The entire operation is financed by a special rate charge. Daily reports are made on trouble areas, and monthly reports are given on how much sewer line was cleaned and repaired, on the number of complaints, and on recommended solutions. Equipment is serviced regularly and purchases are based on the amount of cleaning and repair work to be done. (Collins-FIRL)
W77-06989

APPARATUS FOR DISPOSAL OF EFFLUENTS.
For primary bibliographic entry see Field 5E.
W77-07002

THE OPERATIONS SECTION OF LINCOLN SEWAGE DIVISION,
For primary bibliographic entry see Field 5D.
W77-07023

MUNICIPAL WASTE WATER TREATMENT AS AN INDUSTRIAL OPERATION,
Environmental Quality Systems, Inc., Rockville, Md.
For primary bibliographic entry see Field 5D.
W77-07025

FAIL-SAFE WASTE TREATMENT SYSTEM,
CH2M/Hill, Reston, Va.
For primary bibliographic entry see Field 5D.
W77-07027

SLUDGE DEWATERING ON ALASKA'S NORTH SLOPE,
For primary bibliographic entry see Field 5D.
W77-07030

NUTRIENT REMOVAL BY WATER HYACINTHS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
D. A. Cornwell, J. Zoltek, Jr., C. D. Patrinely, T. deS. Furman, and J. I. Kim.
Journal Water Pollution Control Federation, Vol 49, No 1, p 57-65, January, 1977. 5 fig, 4 tab, 15 ref.

Descriptors: *Nutrient removal, *Water hyacinth, *Waste water treatment, *Eutrophication, *Aquatic algae, *Biochemical oxygen demand, Nitrogen, Phosphorus, Water pollution effects, Water quality.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

Hyacinths were studied as nutrient removal agents for use in combating eutrophication. Experiments on effluent from the University of Florida Waste Water Treatment Plant (Gainesville) were conducted in a 3-phase study to determine if there was a significant reduction of nitrogen and phosphorus in a plant scale operation during winter, to determine growth patterns and effectiveness, and to study effects of detention time and depth. Resultant data showed that water hyacinths' nutrient removal capacities were directly related to pond surface area; that depth and detention time must allow a given surface area per unit flow through the pond (80% nitrogen and 44% phosphorus removal were gained with 5.1 acres hyacinths per 1 mgd); and that nutrient uptake was good during the increase in area-growth phase and during the vertical-growth phase. The nitrogen removal factor may make the plants useful in eutrophication control. Nutrients which sloughed off during the death phase remained in ponds as a bottom sediment and reduced the need for hyacinth harvesting. The most profitable use of the dead hyacinths would be as compost. (Collins-FIRL)

W77-07036

ON THE SELF-PURIFICATION OF NATURAL WATERS, (IN GERMAN),
Limnologische Station Niederrhein in der Max-Planck-Gesellschaft z.F.d.W., Krefeld (West Germany).
K. Seidel.
Naturwissenschaften 63(6), p 286-291, 1976.

Descriptors: *Self purification, *Bacteria, Organic matter, Viruses, Water purification, Water treatment, Public health.

Whether the work of planting in natural waters is worthwhile and should be encouraged is questioned. Investigations with higher plants and emerged plants show that higher plants exert a strong influence on organic and inorganic matter, pH regulation, destruction of pathogenic bacteria, worms, eggs and viruses and also how they influence the waters and waste waters.—Copyright 1977, Biological Abstracts, Inc.
W77-07038

WHAT'S NEW IN LANDFILL LINERS.
The American City and County, Vol 92, No 2, p 54-56, February, 1977. 2 tab.

Descriptors: *Linings, *Landfills, *Water pollution control, Groundwater, Surface waters, Plastics, Asphalts, Cements, Rubber, Impervious membranes, Adhesives, Films, Polymers, Leachates, Economics, Oxidation, Temperatures, Anaerobic conditions, Environment.

Landfill linings have been used to control ground and surface water pollution resulting from landfill operations. Linings suitable for the disposal of various fluids or wastes were described. These include polyethylene (PE), plasticized polyvinyl chloride (PVC), butyl rubber sheeting, chlorosulfonated polyethylene sheeting (Hypalon), ethylene propylene rubber (EPDM), chlorinated polyethylene (CPE), admix liners, asphalt concrete, hydraulic asphalt concrete, soil asphalt, bituminous seal-catalytically blown asphalt, and bituminous seal-fabric plus asphalt emulsion. Selection often depends upon the economics of usage and the length of time the liner will be in service. Combinations of linings are sometimes preferable to single ones. Seaming is important with liners because they are usually manufactured in narrow sheets. Factory seaming usually employs electronic sealing, 'solvent welding', or heat curing adhesives. The use of adhesives is restricted by the specific polymer and specific compounding recipe for which they are designed. Environmental conditions often affect the usefulness of these liners. Anaerobic conditions, normally found at the bottom of landfills, prevent ox-

idation of liner materials. The liners should be placed on surfaces graded to allow drainage; objects that could cause cracking of hard liners should be removed. Polymeric materials should be protected from light which degrades the materials. Wet-humid conditions should be reduced, especially when leachate is regularly produced, to prevent leaching from a liner, and temperatures should be in the 40-70 F range. Acidic conditions and high leachate ion concentrations should also be avoided. (Collins-FIRL)
W77-07051

PHOSPHATES IN SOILS TREATED WITH SEWAGE WATER: I. GENERAL INFORMATION ON SEWAGE FARM, SOIL, AND TREATMENT RESULTS,
Agricultural Univ., Wageningen (Netherlands).
J. Beck, F. A. M. de Haan, and W. H. van Riemsdijk.
Journal of Environmental Quality, Vol 6, No 1, p 4-7, January-March, 1977. 1 fig, 3 tab, 7 ref.

Descriptors: *Phosphates, *Soils, *Sewage treatment, Sewage effluents, Sewage disposal, Organic matter, Inorganic compounds, Biochemical oxygen demand, *Waste water treatment, Waste water disposal.
Identifiers: Sewage farms.

Research conducted at a sewage farm used for 50 years was described. The 247 acre area was reclaimed from uncultivated woodland on sandy soil. A comparison of the composition of the added waste water and the drainage water can be indicative of the effectiveness of this treatment method. Water analysis results can be supported with soil analysis data. Analysis of sodium, potassium, cadmium, manganese, silica dioxide, iron, and chlorine did not reveal any significant differences, indicating a degree of soil system equilibrium relative to these compounds. Data indicated that the soil is an active filter for organic carbon compounds, as well as for organic and inorganic phosphorus compounds. These and other collected data showed land disposal of raw sewage water is still effective in reducing BOD and removing phosphates, even after 45 years of use. The use of this land as permanent pasture can be combined with waste water treatment up to a waste water level thickness of 2.5 meters on an annual basis. This treatment raises soil pH and increases organic matter content. Nitrogenous compounds are transformed into nitrate nitrogen and nitrogen removal by soil treatment is relatively low. Both adsorption and precipitation reactions play a role in phosphate bonding by soil and phosphate accumulation is mostly limited to the top 50 centimeters. (See also W77-07053 and W77-07054) (Collins-FIRL)
W77-07052

CONDITIONING AND LAND APPLICATION OF AEROBICALLY DIGESTED SLUDGE,
Montgomery County Sanitary Dept., Dayton, Ohio.
For primary bibliographic entry see Field 5D.
W77-07058

SHORT COURSE PROCEEDINGS: APPLICATIONS OF STORMWATER MANAGEMENT MODELS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-07066

INTRODUCTION TO URBAN STORM WATER RUNOFF MODELS,
Water Resources Engineers, Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-07071

THE WRE STORM MODEL,
Water Resources Engineers, Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-07073

WATER QUALITY SIMULATION OF TAHOE-TRUCKEE SYSTEM, NEVADA-CALIFORNIA VOLUME I,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 5B.
W77-07075

WATER QUALITY INVESTIGATIONS IN THE SOUTH PLATTE RIVER BASIN, COLORADO, 1971-72.
National Field Investigations Center, Denver, Colo.
For primary bibliographic entry see Field 5A.
W77-07076

DEVICE FOR SUCKING THE UPPER LAYER OF A POLLUTED WATER SURFACE,
L. Chastan-Bagnis.
United States Patent 4,008,156. Issued February 15, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 3, p 935, February, 1977. 1 fig.

Descriptors: *Patents, Equipment, *Separation techniques, *Specific gravity, Separation, Water pollution control, Surface waters, Pollutants, Water quality control, Pollution abatement.

A patent was issued for a device to collect floating pollutants from water surfaces. The mechanism has an inlet opening in the forward portion connected to a channel with extending side walls so that polluted water flows through the channel from the inlet opening. A collection chamber is provided with means to separate the polluting material according to their specific gravities. A negative pressure area sucks the pollutant into the collection chamber and means are provided to remove separated water and pollutants from the collection chamber. (Collins-FIRL)
W77-07089

INTEGRATED APPROACH TO URBAN WASTE WATER MANAGEMENT,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 5D.
W77-07095

A NONLINEAR MULTILEVEL TRANSPORTATION MODEL FOR WATER RESOURCE-WATER QUALITY MANAGEMENT,
Utah State Univ., Logan.
For primary bibliographic entry see Field 5B.
W77-07096

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

AN INPUT-OUTPUT ANALYSIS OF ENVIRONMENTAL PRESERVATION,
Manitoba Univ., Winnipeg. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06706

TWO-GOAL REGIONAL ENVIRONMENTAL POLICY: THE CASE OF THE SANTA ANA RIVER BASIN,
Tel-Aviv Univ. (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W77-06707

MATHEMATICAL MODELS IN HYDROLOGY.
United Nations Educational, Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 2A.
W77-06708

ON THE APPLICATION OF OPTIMIZATION TECHNIQUES TO CONCEPTUAL CATCHMENT MODELS.
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 2A.
W77-06709

USE OF A PARAMETRIC MODEL AS A TOOL FOR HYDROMETRIC NETWORK PLANNING.
Waterloo Univ., (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06710

INDICES OF WATER RESTRICTION AND WATER DEFICIENCY TOLERANCE.
Research Inst. for Water Resources Development, Budapest (Hungary).
M. Domokos.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 865-875. 4 fig, 10 ref.

Descriptors: *Water resources development, *Water demand, Planning, Management, Stochastic processes, Evaluation, Equations, Constraints, Systems analysis.
Identifiers: *Water restriction indices, *Water deficiency.

One of the groups of limiting conditions serving as a basis of planning of water development systems is that of the limit values of the indices characterizing the restriction in satisfying water demands, i.e., by the so-called water deficiency tolerance indices. A general theory of water restriction indices has been developed. First some properties of the time functions of the available water resources and of the water demands are analyzed or prescribed, respectively, as well as some properties of the periods considered, all of which can be of use for the construction of the theory. Then the concept of the water restriction indicator function is introduced. The water restriction index is defined as the expected value of this indicator function considered as a stochastic process. Three particular concrete water restriction indices incorporated in this theory are discussed. These are: the relative duration of water restriction surpassing a certain degree; the average relative water deficiency and the mean square relative deficiency. Simple formulae are deduced for the calculation of these indices. Their applicability in the practice of water resources management is also appraised. (See also W77-06708) (Bell-Cornell)
W77-06711

COLLECTIVE UTILITY: A SYSTEMS APPROACH TO WATER PRICING POLICY.
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 6C.
W77-06712

THE CONJUNCTIVE USE OF A MULTI-RESERVOIR SYSTEM AND A DUAL-PURPOSE DESALTING PLANT.
Sahand Co., Tehran (Iran).
For primary bibliographic entry see Field 4B.
W77-06714

OPTIMAL OPERATIONS OF RESERVOIRS IN THE HARZ MOUNTAINS.
Technische Universitaet, Brunswick (West Germany). Leichtweiss Inst. for Water Research.
For primary bibliographic entry see Field 4A.
W77-06715

METHODS FOR CONTROL OF THE REGIMES FOR WATER RESOURCES SYSTEMS.
Moskovskii Energeticheskii Institut (USSR). Dept. of Hydropower.
For primary bibliographic entry see Field 4A.
W77-06717

OPTIMAL COMPLEX USE OF CONTROLLED WATER RESOURCES OF A BASIN.
Akademiya Nauk SSSR, Moscow. Central Economic Mathematical Inst.
For primary bibliographic entry see Field 4A.
W77-06718

MATHEMATICAL MODEL OF WATER RESOURCES UTILIZATION IN A RIVER BASIN.
Akademiya Nauk SSSR, Moscow. Institut Vodykh Problem.
For primary bibliographic entry see Field 4A.
W77-06719

OPTIMIZATION OF A THREE-RESERVOIR SYSTEM BY DYNAMIC PROGRAMMING.
Ministerio de Obras Publicas, Madrid (Spain). Geologico Servicio.
For primary bibliographic entry see Field 4A.
W77-06720

OPTIMAL DESIGN AND OPERATION OF RESERVOIR SYSTEMS.
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-06721

INTEGRATION OF AQUIFERS IN FLOOD CONTROL PROJECTS.
Technion - Israel Inst. of Tech. Haifa. Dept. of Agricultural Eng.
For primary bibliographic entry see Field 4A.
W77-06723

OPTIMAL SEASONAL AND SHORT-TERM OPERATION OF A RESERVOIR USED FOR FLOOD CONTROL AND WATER SUPPLY.
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-06724

STREAMFLOW REGULATION BY ARTIFICIAL RECHARGE FED FROM UPSTREAM SURFACE STORAGE: DERIVATION OF CONTROL RULES.
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-06725

THE METHODS OF DISTRIBUTION OF WATER RESOURCES IN RIVER DEVELOPMENT SYSTEMS.
Akademiya Nauk SSSR, Moscow. Institut Vodykh Problem.
For primary bibliographic entry see Field 4A.
W77-06726

MODELE MATHEMATIQUE DE SIMULATION DU SYSTEME DES RESSOURCES HYDRAULIQUES SUPERFICIELLES DU LLOBREGAT.
Ministerio de Obras Publicas, Barcelona (Spain). Study and Experimental Centre.
For primary bibliographic entry see Field 4A.

W77-06727

CONJUNCTIVE USE OF THE TAJO-SEGURA AQUEDUCT SURFACE SYSTEM AND THE AQUIFERS OF THE LA MANCHA AREA.
Ministerio de Obras Publicas, Madrid (Spain). Geologico Servicio.
For primary bibliographic entry see Field 4B.
W77-06728

OPTIMAL PLANNING OF FLOWS IN MULTI-RESERVOIR HYDRO-POWER SYSTEMS.
Boeing Computer Services Inc., Seattle, Wash. Mathematical Analysis Unit.
For primary bibliographic entry see Field 4A.
W77-06730

A SECTOR MODEL FOR REGIONAL AND NATIONAL WATER RESOURCES PLANNING.
Harvard Univ., Cambridge, Mass. Center for Population Studies.
P. Rogers.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1040-1047. 3 fig, 1 tab, 17 ref.

Descriptors: Water resources, *Long-term planning, *Regional development, *Evaluation, *Scheduling, *Investment, *Economics, Water policy, Decision making, Agriculture, Constraints, Input-output analysis, Project planning, Methodology, Mathematical models, Systems analysis, Optimization, Linear programming.
Identifiers: *Multi-level sector model, Mixed-integer programming, Intersectoral planning, Benefit functions, Benefit maximization, Government decision model, Producer decision model, East Pakistan.

A multi-level sector model is proposed to evaluate the selection of optimal schedules from all possible investments in the water sector of an economy by regions and over time. The interregional and intertemporal nature of the model allows for the evaluation of policy decisions concerning preferred regional growth and balance. An example based on planning for the use of water for agricultural development in the Province of East Pakistan is discussed. Although the model is of only the water sector, the constraints upon it relate it to intersectoral input-output models of the regional and national economy. The crux of the intersectoral planning problem is to be able to set the size of the resource allocation to each of the sectors. The model focuses on the investment decision within the sector itself rather than between the sectors. The overall model is split into two separate but complementary models, called the Governmental Decision Model and the Producer Decision Model; the former utilizes mixed-integer programming and the latter employs continuous linear programming. A summary comparison between the two models is given; the objective of both is benefit maximization. (See also W77-06708) (Bell-Cornell)
W77-06731

HYDROLOGICAL EVALUATION OF CHANGES IN RUNOFF CHARACTERISTICS.
Hydrologic Engineering Center, Davis, Calif.
For primary bibliographic entry see Field 4A.
W77-06732

GENERAL DESCRIPTION OF THE VISTULA RIVER PROJECT AND BASIC PLANNING DATA.
Bureau of Studies and Designs for Hydraulic Structures, Warsaw (Poland).
For primary bibliographic entry see Field 4A.
W77-06733

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

THE MULTI-STEP METHOD FOR SIMULATION AND OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES, Technical Univ., Warsaw (Poland). Inst. of Environmental Engineering.
For primary bibliographic entry see Field 4A.
W77-06734

THE OUT-OF-KILTER ALGORITHM AS A SINGLE-STEP METHOD FOR SIMULATION AND OPTIMIZATION OF VISTULA RIVER PLANNING ALTERNATIVES, Water Resources Engineers Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 4A.
W77-06735

LA SCIENCE DES SYSTEMES DANS LA PLANIFICATION DES RESSOURCES EN EAU, Catania Univ. (Italy). Istituto di Idraulica Idrologia Gestione Acque (Italy).
E. Guggino.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1084-1092. 7 ref.

Descriptors: *Water resources, *Management, *Planning, *Systems analysis, Methodology, Operations research, Economics, Hydrology.
Identifiers: *System science, Multiple objectives.

This paper studies the current status of water resources management through System Science. Having given some basic definitions, the necessity is shown of facing the problem of rational water resources management through active interdisciplinary research which could avoid fragmented and distorted points of view and which could state the problem within the more general framework of territorial management and economic programming. The methodology of approach through System Science is described, its different phases are analyzed, and finally some conclusions are drawn on the basis of the applications already implemented. (See also W77-06708) (Bell-Cornell)
W77-06736

A DYNAMIC MULTISECTOR PROGRAMMING APPROACH TO REGIONAL WATER RESOURCE MANAGEMENT, Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div.
J. Bargar.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2. IAHS/Unesco, Paris, France, 1974, p 1094-1110. 3 fig, 7 tab, 16 ref, 2 append.

Descriptors: *Water resources, *Water management (Applied), Regional development, Comprehensive planning, *Optimization, Input-output analysis, Linear programming, California, Projects, Alternative planning, Economic efficiency, Constraints, Methodology, Investment, Water requirements, Equations, Mathematical models, Systems analysis.
Identifiers: *General equilibrium analysis, Western US, Benefit maximization, Activity analysis model, Basic programming model, Shadow prices, Cropping pattern.

Market forces have failed in the area of development, allocation and management of natural resources in general and of water resources in particular. The shaping of public investment programs for water resources development has long been dominated by partial equilibrium analyses such as 'benefit cost' analysis (B/C). However, this approach is rather limited for an interregional intertemporal management program of water resources. This study offers a multisector planning and management approach for water resources

based on a general equilibrium analysis employing input-output models and linear programming techniques. A dynamic multisector programming model which accounts for the sectoral, spatial, and temporal aspects of regional planning is formulated and applied empirically for California and the western U.S. for a 15-year planning horizon. The objective of this basic model is to maximize the gross intertemporal interregional product up to the target year and from then on to infinity. An extension to an activity analysis model of various types of water production activities is offered to provide a choice among alternative development projects; the objective of this model is maximization of consumption. Results of the empirical application pertain to water requirements forecasts, interregional water transfer requirements, efficient production and cropping pattern, 'shadow prices' for water and labor and an optimal investment program for water resources projects. Use of this model has enabled the investigation of regional development dependent upon the interrelationships between resource availabilities and sectoral planning, illustrating complex interdependencies among economic variables. (See W77-06708) (Bell-Cornell)
W77-06737

SHORT COURSE PROCEEDINGS: APPLICATIONS OF STORMWATER MANAGEMENT MODELS, Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-07066

A NONLINEAR MULTILEVEL TRANSPORTATION MODEL FOR WATER RESOURCE-WATER QUALITY MANAGEMENT, Utah State Univ., Logan.
For primary bibliographic entry see Field 5B.
W77-07096

6B. Evaluation Process

DESIGN STUDY OF ENVIRONMENTAL AND HUMAN CULTURAL INFORMATION SYSTEM NEEDS IN URBAN WATER RESOURCE DEVELOPMENT, Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Architecture and Urban Studies.
J. E. Hackett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 957, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, September 1976. 161 p., 18 fig, 47 ref. OWRB B-062-VA(2).

Descriptors: *Management, *Land use, *City planning, *Resources development, *Information exchange, Water policy, Environment, Planning, Water resources development, Data collections, *Alternative planning, Social needs, Social values, Institutions, Comprehensive planning.
Identifiers: Resource analysis, Public planning.

The scope, scale and content of comprehensive information systems for urban environmental resource management are a function of several variables including the purpose and scope of the management study, scale and specificity of the applications level of complexity of the analysis method, and the objective of the planning program. These affect the organizational structure and content of the information system as it is designed for a particular application, whether that application is a tailored solution to a specific resource problem or whether it is a general course of action to be followed in future urban area development. In any urban application, a systematically structured information system should be developed that includes the full range of parameters associated with the urban system as well as

the environmental system. A particular need exists for more thorough consideration of social factors and a descriptive framework is presented for incorporation of these factors. This research also addresses the relationship of form and content of information systems to the methods and techniques of analysis used and the influence of urban area planning approaches on the structure, content and use of information inputs. The current status of water resource planning is reviewed, indicating the need for a general process that incorporates the operational frame of resource management in the more comprehensively organized, public decision-making frame of urban land use planning. A two-stage process for management planning is developed. The process provides for the formulation, design, and implementation of an integrated management program through a series of progressively dependent activity phases. The definition stage is directed to the objective determination of problems along with a preliminary assessment of management needs to provide the basis for the specification by the public involved of the management objectives. This stage is accomplished through a three-phase program formulation, area-wide inventory and analysis, and public definition of management objectives. In the second stage, management alternatives to the stated objectives are defined and evaluated, the management program is selected and implemented, and procedures for continuing public and technical review are instituted. Technical involvement during the management stage is likely to be significantly greater than in the definition stage because extensive programs of data collection and the application of more sophisticated techniques of systems analysis and program evaluation are more likely to be required.
W77-06634

UNCERTAINTY AND THE CHOICE OF POLLUTION CONTROL INSTRUMENTS, Tel Aviv Univ. (Israel). Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06704

OPTIMAL INVESTMENT IN POLLUTION CONTROL CAPITAL IN A NEOCLASSICAL GROWTH CONTEXT, Pittsburgh Univ., Pa. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-06705

A SECTOR MODEL FOR REGIONAL AND NATIONAL WATER RESOURCES PLANNING, Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 6A.
W77-06731

A DYNAMIC MULTISECTOR PROGRAMMING APPROACH TO REGIONAL WATER RESOURCE MANAGEMENT, Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div.
For primary bibliographic entry see Field 6A.
W77-06737

ENVIRONMENTAL IMPACT STATEMENTS IN WATER RESOURCES PLANNING AND DECISION MAKING, Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6E.
W77-06738

IMPROVEMENT OF PLANNING FOR POST-DEVELOPMENT WATER RESOURCE MANAGEMENT: A STUDY OF THE WEBER BASIN PROJECT, Utah State Univ., Logan. Inst. for Social Science Research on Natural Research.
G. E. Madsen, and W. H. Andrews.

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 009, Price codes: A05 in paper copy, A01 in microfiche. Research Monograph No. 6, September 1976. 90 p, 1 fig, 6 tab, 53 ref. OWRT C-6092(No. 5212)(1), 14-31-0001-5212.

Descriptors: *Management, *Planning, Social impacts, Social change, *Utah, River basin development, Water resources development, Post-impoundment, Water management(Applied), Future planning(Projected), Water demand, Recreation, Urbanization, Irrigation systems, Attitudes.
Identifiers: *Weber Basin Project(Utah).

The objectives of this research were: (1) identify present management problems in the Weber Basin Project of Utah; (2) identify whether the problems are related to the planning process so that relationships between planning and management can be identified; (3) identify recommendations from present management personnel concerning changes in planning which might help alleviate management problems with future projects, as well as recommendations for present solutions to problems; (4) identify theoretical elements which can be applied to future planning. Data for the study came from three sources: indepth interviews with officials representing management agencies in the Weber Basin Project; secondary data from organizational records, previous research studies, and planning documents; and two seminars with management officials. Present management problems were being experienced primarily in two areas, urban pressurized irrigation systems (where the non-treated water is used for residential lawns, gardens and shrubs), and the recreation component of the project. Several recommendations for future water resources planning grew out of this project. Two of the most important were: (1) many of the present problems are related to changes in the project which occurred largely since the initial planning and development. Therefore, it appears that more emphasis needs to be given to a broad program of continuous planning through the lifetime of future projects; (2) it would be helpful to have periodic meetings at the early stages of the project and continue them through the operation.
W77-06739

ECONOMIC ANALYSIS OF ALTERNATIVE GROUNDWATER WITHDRAWAL RATES IN CONJUNCTION WITH SURFACE WATER IRRIGATION,
Washington State Univ., Pullman. Coll. of Agriculture.
For primary bibliographic entry see Field 4B.
W77-06740

PROGRAM DEVELOPMENT PLAN. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF,
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 6G.
W77-06878

OPEN SPACE AND URBAN WATER MANAGEMENT. PHASE II: CASE STUDIES AND FINDINGS,
North Carolina Univ. at Chapel. Dept. of City and Regional Planning.
K. Elfers, and M. M. Hufschmidt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 087, Price codes: A07 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No. 122, December 1976. 225 p, 5 fig, 1 tab, 153 ref. OWRT B-086-NC(1). 14-31-0001-5101.

Descriptors: *Urban hydrology, *Land use, Water resources, Water management(Applied), Ecosystems, Preservation, Urban runoff,

*Planning, North Carolina, Urban drainage, Small watersheds, *Management, *Watershed management, Southeast US, Water quality.
Identifiers: *Urban water management, *Open spaces preservation, Urban water resources, *Crabtree Creek watershed(NC), *Eno River watershed(NC), Raleigh area(NC), Durham area(NC), *Piedmont region(NC).

A detailed examination was made of local goals, criteria, and planning strategies for the preservation of open space and the related management of urban water resources. The key elements are two extensive case studies of small, urbanizing watersheds in the Piedmont Region of North Carolina. The two watersheds offer good examples of the diverse problems, issues, goals, and criteria that may be involved in open space preservation and related urban water management. Crabtree Creek watershed, near and including part of Raleigh, N.C., offers a case study in which (1) several City and County agencies have been involved in open space and related urban water management activities, (2) the State is expanding a major State Park, (3) the SCS is helping to implement a system of flood control impoundments, (4) the EPA is reviewing the probable impacts of a proposed major sewer interceptor, and (5) the Corps of Engineers and the Bureau of Outdoor Recreation are studying alternative flood control/recreation plans for the main stem of the Crabtree Creek within Raleigh. The Eno River watershed near Durham, N.C., offers an important contrast in that the watershed is more rural and scenic with steep valleys and narrow floodplains. Thus, interest has focused on preserving much of the river valley in its natural state and on creating a State Park. The recommendations fall into two basic categories: (1) those of a planning strategy or procedural nature which would be applicable to all areas of the country; and (2) those consisting of planning criteria and standards of a quantitative nature which, although expressed in terms of acceptable ranges of values, are directed toward the Piedmont Region of the southeastern United States. (See also W75-07596) (Kiger-North Carolina State)
W77-06917

ENVIRONMENTAL POLLUTION: IS THERE ENOUGH PUBLIC CONCERN TO LEAD TO ACTION,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 6G.
W77-06955

A NEW RESERVOIR AND RECREATIONAL BEHAVIOR,
Oklahoma State Univ., Stillwater. Dept. of Geography.
R. D. Hecock.
Growth and Change, Vol. 5, No. 3, July 1974, p 17-20. 3 fig, 3 tab.

Descriptors: *Recreation, *Reservoirs, Behavior, *Social impact, Surveys, Water resource development, Benefits, *Oklahoma, Attitudes, Estimating, Land use.
Identifiers: *Keystone Reservoir(OK), *Recreation participation rates, Land and Water Conservation Act, Public access.

Estimating the nature and extent of a new reservoir's impact on the recreational behavior of the population surrounding the reservoir is discussed. Recreational benefits of federal reservoirs are currently calculated on predictions of gross attendance. But distortions occur because projected attendance will be greatest where there is presently a large participating population, and where there is multiple counting of active participants. It is necessary to understand how participation is developed in an area previously without any access to water resource recreation. The Keystone Reservoir, in northwest Oklahoma, completed in 1964 and containing 26,000 acres of water surface,

was used as a case study. Surveys were taken between 1960 and 1970. Thirty-five percent of outdoor recreationists said Keystone stimulated a change in their recreation behavior; 25% of total respondents indicated the lake influenced their recreation behavior. In both groups about 40% reported increases in recreation participation rates, while 30% reported unchanged participation rates. The data suggest a steep distance-decay function exists, explaining a strong reverse relationship between distance from the reservoir and the proportion of respondents whose recreation behavior was influenced by Keystone. Conclusions are that different types and locations of facilities will result if emphasis on gross participation rates is reduced, and increased weight is given to rates of non-participation. Several smaller reservoirs would have a larger impact on recreation behavior than one large reservoir due to the high degree of localization of impact on recreation behavior. (Gentry-North Carolina)
W77-06956

ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 4: THE BACKGROUND PAPERS,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 6G.
W77-06957

WATER QUALITY MANAGEMENT AND THE DISTRIBUTION OF EMISSION RIGHTS BY SEALED TENDER MARKETS,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 5E.
W77-06976

A NONLINEAR MULTILEVEL TRANSPORTATION MODEL FOR WATER RESOURCE-WATER QUALITY MANAGEMENT,
Utah State Univ., Logan.
For primary bibliographic entry see Field 5B.
W77-07096

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS,
Mathews (A. A.), Inc., Rockville, Md.
For primary bibliographic entry see Field 8A.
W77-06662

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS, APPENDIX A—BASELINE COST ANALYSES,
Mathews (A. A.), Inc., Rockville, Md.
For primary bibliographic entry see Field 8A.
W77-06663

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS, APPENDIX B—SUBTERRANEAN COST ANALYSES,
Mathews (A. A.), Inc., Rockville, Md.
For primary bibliographic entry see Field 8A.
W77-06664

THE GENERATION OF RESIDUAL FLOWS IN NORWAY: AN INPUT-OUTPUT APPROACH,
Oslo Univ. (Norway). Inst. of Economics.
For primary bibliographic entry see Field 5G.
W77-06698

Field 6—WATER RESOURCES PLANNING

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

POLLUTERS' PROFITS AND POLITICAL RESPONSE: DIRECT CONTROL VERSUS TAXES: COMMENTS AND REPLY.
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for the Study of Public Choice. For primary bibliographic entry see Field 5G. W77-06700

COLLECTIVE UTILITY: A SYSTEMS APPROACH TO WATER PRICING POLICY.
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
L. Duckstein, and C. C. Kisiel.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 2, IAHS/Unesco, Paris, France, 1974, p. 879-886. 1 tab, 11 ref. OWRT A-024-ARIZ(10).

Descriptors: *Water policy, *Pricing, Water distribution(Policy), Assessment, Water rates, Regions, Arizona, Equations, Mathematical models, Cost-benefit analysis, Conservation, Behavior, Systems analysis, Methodology.
Identifiers: *Collective utility, Tucson(Arizona), Comparison.

Collective utility of a region based on Lesourne's theory is used to compare water pricing policies in Tucson, Arizona over a single time period. The present method of marginal pricing (regressive block rate) is compared to a hypothetical conservation pricing (progressive block rate). Well-defined hypotheses are made about the behavior of consumers served by the water distribution company. The value of the change in collective utility determines which price structure should be adopted once model parameters are known and once a value has been inputted to conservation. A progressive rate structure decreases the total consumption. When peak consumption is lowered, lower capital expenditures occur. Extensions of the model to multi-period policies and uncertainty of future conditions are presented. The analysis is appropriate wherever a central water agency exists. Collective utility as an approach to analysis of water resource systems is contrasted with the techniques of cost-effectiveness and cost-benefit analyses. Although a progressive price structure goes against the established principle of 'marginal pricing' (the more water is produced, the cheaper it is sold), preliminary calculations show that a permanent change to such a structure increases the collective utility. The collective utility approach can be used for sequential decision making on price structures. (See also W77-06708) (Bell-Cornell)
W77-06712

A UNIVERSAL CALIBRATION EQUATION FOR PRICE METERS AND SIMILAR INSTRUMENTS.
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 7B. W77-06943

6D. Water Demand

THE GROWTH SHAPERS: THE LAND USE IMPACTS OF INFRASTRUCTURE INVESTMENTS.
Urban Systems Research and Engineering, Inc., Cambridge, Mass.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$1.30. Prepared for the Council on Environmental Quality, Washington, D.C., May 1976. 71 p, 44 fig, 37 ref, 1 append.

Descriptors: *Environmental effects, *Land use, *Capital investment, *Sewers, *Highways, *Land development, *Land management, *Land resources, Investment, Airport, Social aspects.

Identifiers: *Infrastructure, *Public investment, Economic aspects, Mass transit.

The link between infrastructure facilities such as water and wastewater systems, power supplies, highway and road networks, mass transit systems and airports, and land use is explored. Focusing on how infrastructure investments can shift existing or potential demand for land, there is, however, no agreement on the question as to whether infrastructure investment actually creates growth or merely concentrates a region's development into its own service area. Steps to estimate what development will occur for a given investment are: (1) define the impact area; (2) inventory the supply of land in an area; (3) estimate demand for land; (4) use supply and demand analysis to determine what development will occur; (5) estimate impacts of the amount, pattern, and rate of development; and (6) determine how the impacts, related to the investment, can then be controlled. Impacts of infrastructure induced development may be controlled by reduction in capacity of the infrastructure, thereby limiting demand; changing the route of the infrastructure investment; staging the investment in phases; zoning (including cluster zoning, density zoning and planned unit development); public purchase of land rights (i.e., land banking). Regulations setting performance standards for environmental management and building codes can be used to control subdivision development and construction. Detailed analysis, using the above methodology, is presented for highways, mass transit, and sewers. (Gentry-NC)
W77-06601

INDICES OF WATER RESTRICTION AND WATER DEFICIENCY TOLERANCE.
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6A. W77-06711

OPTIMIZATION OF A THREE-RESERVOIR SYSTEM BY DYNAMIC PROGRAMMING.
Ministerio de Obras Publicas, Madrid (Spain). Geologico Servicio.
For primary bibliographic entry see Field 4A. W77-06720

IMPROVEMENT OF PLANNING FOR POST-DEVELOPMENT WATER RESOURCE MANAGEMENT: A STUDY OF THE WEBER BASIN PROJECT.
Utah State Univ., Logan. Inst. for Social Science Research on Natural Resources.
For primary bibliographic entry see Field 6B. W77-06739

PRELIMINARY ASSESSMENT OF THE WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON.
Geological Survey, Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 4A. W77-06971

WATER IN THE PALOUSE RIVER BASIN, WASHINGTON.
Geological Survey, Madison, Wis. Water Resources Div.; and Geological Survey Tacoma, Wash. Water Resources Div.
For primary bibliographic entry see Field 4B. W77-06978

6E. Water Law and Institutions

ENVIRONMENTAL IMPACT STATEMENTS IN WATER RESOURCES PLANNING AND DECISION MAKING.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.

M. D. Bradley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 023. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, (1976). 161 p, 4 fig, 69 ref. OWRT C-5222(No. 4213)(2).

Descriptors: *Planning, Political aspects, Institutions, Institutional constraints, Water law, *Legislation, *Arizona, *Decision making, Environmental effects.
Identifiers: *Central Arizona Project, *Warm Springs Dam(Ariz), *National Environmental Policy Act, *Environmental impact statements.

The environmental impact statement has an information generating role. But information is not neutral; its generation changes the substance of decision-making. The Centr Arizona Project and the Warm Springs Dam are examples of water projects requiring environmental assessment. The information generated by each EIS was controversial, and higher standards for information gathering and use are needed to assign liability and to clarify risk analysis. NEPA applies universal and objective information demands to a political and ideological policy-making process.
W77-06738

PRELIMINARY BIBLIOGRAPHY ON GROUND-WATER IN DEVELOPING COUNTRIES.
Association of Geoscientists for International Development, St. John's (Newfoundland).
For primary bibliographic entry see Field 2F. W77-06852

POLLUTION PREVENTION, NOT CONTROL CALLED KEY TO A CLEAN ENVIRONMENT.
For primary bibliographic entry see Field 5G. W77-06861

THE LEGAL RESPONSIBILITY OF WATER WELL DRILLERS.
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 5G. W77-06862

6F. Nonstructural Alternatives

FLOOD MANAGEMENT STUDY.
Northern Tier Regional Planning and Development Commission, Towanda, Pa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-249 456. Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Appalachian Regional Commission and the Department of Housing and Urban Development, Washington, D.C. Final Report, October 1974. 82 p, 7 tab, 11 map, 5 append. 73-82 HUD-CPA-1047, ARC-PA-2355/.

Descriptors: *Floods, Flooding, *Flood plain insurance, *Flood plain zoning, *Flood plains, *Flood control, *Non-structural alternatives, *Land use, Flood protection, Drainage channels, Wetlands, Shores, *Pennsylvania, Dams, Reservoirs.
Identifiers: *Flood plain management, Northern Tier Regional Planning and Development Commission, *Hurricane Agnes(1972), *Intermunicipal tax sharing, Appalachian Regional Commission, National Flood Insurance Program, Flood Hazard Boundary Maps.

The Northern Tier Region of PA lies between Elmira, New York and the Scranton/Wilkes - Barre, Pennsylvania metropolitan areas. Primarily rural, it has 160,000 people within 4,000 sq mi. The flood plain management plan was the result of joint HUD and Appalachian Regional Commission funding to provide a Agnes Flood Recovery Grant to the Northern Tier Regional Planning and

Development Commission (NTRPDC) following the 1972 flood from Hurricane Agnes. The report covers hydrology, existing flood control structures, plans and programs for protective works, physical development, management techniques (land use, zoning, intermunicipal tax sharing, flood insurance), economics and natural factors. Some recommendations are: flood management should be based on non-structural alternatives: conventional zoning, the National Flood Insurance Program, and a Development District approach should be given high priority for implementation; the Comprehensive Regional Plan should incorporate preservation of undeveloped aquifer recharge areas, limit flood plain development to agriculture, recreation and other non-structural uses, restrict development according to soil suitability, and preserve vegetative cover along streams and river banks, natural drainage channels, wetlands and shoreline areas; Flood Hazard Boundary Maps developed by the Federal Insurance Administration should define locations of flood plains. Physiographic data and lot and parcel maps can be used by municipalities within the study area to develop comprehensive plans with supporting zoning ordinances. Future flood management and comprehensive plans for the area can be based on data supplied by this study. (Gentry-North Carolina)
W77-06952

DELINEATION OF FLOOD HAZARD AREAS: FLOOD HAZARD REPORT NO. 2, RARITAN RIVER.

Anderson-Nichols and Co., Inc., Boston, Mass.
For primary bibliographic entry see Field 4A.
W77-06953

FLOOD HAZARD INFORMATION: CAVE CREEK, ARIZONA CANAL TO 19TH AVENUE, PHOENIX, ARIZONA.

Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W77-06954

6G. Ecologic Impact Of Water Development

THE GROWTH SHAPERS: THE LAND USE IMPACTS OF INFRASTRUCTURE INVESTMENTS.

Urban Systems Research and Engineering, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 6D.
W77-06601

DESIGN STUDY OF ENVIRONMENTAL AND HUMAN CULTURAL INFORMATION SYSTEM NEEDS IN URBAN WATER RESOURCE DEVELOPMENT.

Virginia Polytechnic Inst. and State Univ., Blacksburg, Coll. of Architecture and Urban Studies.
For primary bibliographic entry see Field 6B.
W77-06634

EVALUATION OF THE ENVIRONMENTAL IMPACT TO APPALACHIAN PENNSYLVANIA WATERS OF THE 1972 FLOOD AND SUBSEQUENT STREAM CHANNELIZATION WITH FUTURE POLICY RECOMMENDATIONS.

Baker (Michael), Jr., Inc., Beaver, Pa.
For primary bibliographic entry see Field 4A.
W77-06676

OPTIMAL OIL TANKER SIZE WITH REGARD TO ENVIRONMENTAL IMPACT OF OIL SPILLS.

California Univ., Los Angeles. Graduate School of Management.
For primary bibliographic entry see Field 5G.
W77-06702

REGULATING CATASTROPHIC ACTIVITIES WITH ENVIRONMENTAL EFFECTS.

California Univ., Riverside. Dept. of Economics.
M. L. Cropper.
Journal of Environmental Economics and Management, Vol 3, No 1, p 1-15, 1976. 4 fig, 12 ref.

Descriptors: *Model studies, *Disasters, *Environmental effects, *Natural resources, *Regulation, Analytical techniques, Accidents, Exploitation, Nuclear powerplants, Water allocation(Policy), Optimization.
Identifiers: *Irreversible effects, *Pollution threshold, Utility, Disutility, Catastrophic pollution, Resource depletion, Nonrenewable resources.

Two models are developed for analyzing the natural resource impacts of two levels of disastrous activity outcomes. The first case hypothesized is that of catastrophic pollution such as might be created by accidents associated with nuclear power plants and stratospheric flight. Such a case involves a temporary reduction of utility, and the model captures the 'small probability of large loss' characteristic of pollution problems associated with these activities by assuming that the uncertain effects of pollution are potentially disastrous. The second case covers an irreversible catastrophe such as the inadvertent depletion of a nonrenewable resource for which no substitute is available. The latter might occur when the total amount of the resource extracted exceeds the uncertain resource stock. Disaster reduces the level of utility to zero, so that in utility terms, catastrophe is equal to zero consumption; the unique and stable equilibrium which characterizes many pollution control models no longer obtains and multiple-equilibria solutions are possible. In the case of resource depletion, it is shown that when reserves are uncertain the path of planned extraction is no longer necessarily monotonic and may even increase over time; future generations may be worse off under uncertainty than they would if the size of the resource stock were certain. (Harris-Wisconsin)
W77-06703

UNCERTAINTY AND THE CHOICE OF POLLUTION CONTROL INSTRUMENTS.

Tel Aviv Univ. (Israel). Dept. of Economics.
Z. Adar, and J. M. Griffin.
Journal of Environmental Economics and Management, Vol 3, No 3, p 178-188, 1976. 3 fig, 7 ref.

Descriptors: *Risks, *Pollution abatement, *Economic efficiency, *Pollution taxes(Charges), Standards, Welfare(Economics), Prices, Optimization, Mathematical studies.
Identifiers: Marginal damage function, Marginal control costs, Pollution rights, Auctions.

The relative efficiencies of pollution taxes, pollution standards, and the auctioning of pollution rights are compared, when the marginal damage function (MDF) or marginal control cost (MCC) are subject to uncertainty. Uncertainty conditions are examined with respect to the three policy choices at the level of the pollution control agency, and at the firm level when combined with risk aversion. It is concluded that: (1) uncertainty in the marginal damage function has no effect on the choice between the three policy instruments, (2) uncertainty in the marginal control cost function will yield different expected welfare losses between taxes or standards or auctions depending on the variance of the stochastic error term and the slopes or elasticities of the MDF and MCC functions; and (3) this asymmetry holds even under risk aversion, with the welfare loss also dependent on the degree of risk aversion. In situations of uncertain MCC where MDF tends to be very price elastic, as with SO₂ emissions, taxes seem most efficient. Where the MDF is very inelastic, quantitative restrictions of an auction or

standards type seem to be desirable. In the latter case, standards introduce added informational uncertainty which seems to dominate possible welfare losses due to wide variations in auction prices. (Luedtke-Wisconsin)
W77-06704

OPTIMAL INVESTMENT IN POLLUTION CONTROL CAPITAL IN A NEOCLASSICAL GROWTH CONTEXT.

Pittsburgh Univ., Pa. Dept. of Economics.
G. W. Gruver.
Journal of Environmental Economics and Management, Vol 3, No 3, p 165-177, 1976. 6 fig, 9 ref.

Descriptors: *Pollution abatement, *Model studies, *Optimum development plans, Investment, Capital, Economic efficiency, Optimization, Mathematical models, Theoretical analysis.
Identifiers: Economic growth.

A neoclassical growth model is employed to study how the optimal division of investment between pollution control capital and directly productive capital varies over time, to determine if it would be optimal to have balanced investment or to specialize in one type of capital at a time, and if it is best to specialize, which type of capital should be accumulated first. Model assumptions treat pollution as a flow which can be measured by an appropriate index. It is considered to have a negative effect on aggregate utility, to be negatively related to the stock of pollution control capital, and to be positively related to aggregate output. The investment process is assumed to be irreversible. The model objective is to maximize the integral of discounted utility over a fixed planning period by optimal choice of the saving rate and of the relative proportion of savings to be allocated to production investment as opposed to pollution control capital. Results indicate that a balanced investment plan will not be optimal, and that the optimal approach would be to first invest in directly productive capital (even though this will cause the flow of pollution to increase) and then subsequently increase investment to control pollution. (Luedtke-Wisconsin)
W77-06705

AN INPUT-OUTPUT ANALYSIS OF ENVIRONMENTAL PRESERVATION.

Manitoba Univ., Winnipeg. Dept. of Economics.
I. F. Lipowski.
Journal of Environmental Economics and Management, Vol 3, No 3, p 205-214, 1976. 18 ref.

Descriptors: *Input-output analysis, *Pollution abatement, Economic feasibility, Mathematical models.
Identifiers: *Environmental quality, *Economic growth, Matrix.

The implications and technical feasibility of a policy of complete environmental preservation within the context of a closed, static input-output model is examined. A well-established criterion for gauging the growth potential of an economy, the technology of which can be represented by a non-negative indecomposable square matrix, is reviewed. The concept of growth upon which this criterion is based is shown to be ambiguous since it ignored the environmental repercussions of economic activity. Assuming that the economy possesses an antipollution technology which may be included in an enlarged technology-environment matrix which is also nonnegative and indecomposable, an alternative criterion to gauge growth potential in the presence of complete environmental preservation is proposed. Building on this new base, the magnitude of the uniform rate of profit which would have to exist in order to assure the technical feasibility of effecting a sudden transition from a situation of zero antipollution activity to one of strict environmental preservation is formulated. Various factors which would facilitate

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

the implementation of an environmental preservation policy, such as technological progress, are also discussed. (Luedtke-Wisconsin)
W77-06706

TWO-GOAL REGIONAL ENVIRONMENTAL POLICY: THE CASE OF THE SANTA ANA RIVER BASIN,
Tel-Aviv Univ. (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W77-06707

ENVIRONMENTAL IMPACT STATEMENTS IN WATER RESOURCES PLANNING AND DECISION MAKING,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6E.
W77-06738

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 1: MARINE MAMMALS, MARINE BIRDS.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending September 1976. Vol 1. Marine Mammals, Marine Birds, November 1976, 601 p.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Mammals, Surveys, Birds, Migratory birds, Habitats, Ecology.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Gulf of Alaska, Bering Sea, Beaufort Sea, Bristol Bay, Norton Sound.

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is directed by the National Oceanic and Atmospheric Administration under the sponsorship of the Bureau of Land Management. The baseline studies in this volume encompass marine mammals and marine birds. (See also W77-06794 thru W77-06824) (Sinha-OEIS)
W77-06793

BASILINE CHARACTERIZATION OF MARINE MAMMALS IN THE BERING SEA,
National Marine Fisheries Service, Seattle, Wash. Marine Mammal Div.
C. H. Fiscus, H. W. Braham, and R. D. Everitt.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 3-29, November 1976. 9 fig, 4 tab, 3 ref.

Descriptors: *Alaska, *Mammals, *Baseline studies, *Resources development, *Environmental effects, *Ecological distribution, Continental Shelf, Ecology, Data collections, Surveys, Seasonal, Water resources.
Identifiers: *Outer Continental Shelf, *Bering Sea, Environmental assessment, Environmental impact, Harbor seals, Sea lions, Whales, Eumetopius, Ziphius cavirostris, Cetaceans.

The number of marine mammals observed along the north coast of the Alaska Peninsula and throughout the eastern Aleutian Islands is summarized. The total number of animals for all species scored is preliminary and does not necessarily reflect the actual number of animals present in each area surveyed. Additional estimates of animal numbers (i.e., relative abundance) will be

provided in the annual report after a systematic analysis of the aerial photographs and other aerial survey data can be prepared. Heavy fog along the Alaska Peninsula and on the northern side of the eastern Aleutian Island not only hindered survey of pinniped rookery and hauling areas but also made observing for cetaceans difficult. Undoubtedly, the number of cetaceans seen does not reflect the total number in this area at this time of the year. (See also W77-06793) (Sinha-OEIS)
W77-06794

ABUNDANCE AND SEASONAL DISTRIBUTION OF MARINE MAMMALS IN THE GULF OF ALASKA,
National Marine Fisheries Service, Seattle, Wash. Marine Mammal Div.
C. H. Fiscus, H. W. Braham, and R. W. Mercer.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 30-32, November 1976. R7120806.

Descriptors: *Alaska, *Baseline studies, *Ecological distribution, *Resources development, *Data collections, *Environmental effects, Water resources, *Mammals, Surveys.
Identifiers: *Outer Continental Shelf, *Gulf of Alaska, Environmental assessment, Environmental impact, Eumetopius jubatus, Eschrichtius robustus.

The northern and coastal regions of the Gulf of Alaska are expected to be important areas where oil-gas research and tanker traffic will occur. These areas also represent localized habitats for breeding marine mammals (e.g. northern sea lion, Eumetopius jubatus) and for seasonal migration (e.g. California gray whale, Eschrichtius robustus). The baseline objectives of this project are to provide an understanding of the relative seasonal distribution and abundance of marine mammals. Sighting records taken aboard NOAA ships and chartered vessels working in and crossing the gulf in this quarter, data from aircraft surveys collected by supporting OCSEAP projects, and historical whaling and sealing records have been gathered and prepared for analysis. (See also W77-06793) (Sinha-OEIS)
W77-06795

DISTRIBUTION AND ABUNDANCE OF BOWHEAD AND BELUKHA WHALES IN THE BERING AND CHUKCHI SEAS,
National Marine Fisheries Service, Seattle, Wash. Marine Mammal Div.
C. H. Fiscus, H. W. Braham, B. D. Krogman, and R. D. Everitt.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 33-42, November 1976. 1 tab. R7120807-8.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Ecological distribution, *Data collections, *Environmental effects, Water resources, Mammals, Surveys.
Identifiers: *Outer Continental Shelf, *Environmental assessment, Environmental impact, Beaufort Sea, *Chukchi Sea, Aerial surveys, Whales, Cetaceans, Balaena mystecetus, Delphinapterus leucas, *Bering Sea.

The objectives of this project were to make estimates on the distribution and abundance of bowhead (Balaena mystecetus) and belukha (Delphinapterus leucas) whales in the Bering and Chukchi Seas. Observations on marine mammals were made throughout the daylight hours on ship cruises. Other data recorded were animal behavior, environmental parameters, exact position, etc. Computer programs were written which will allow all bowhead and belukha sightings to be plotted by time and position. The fall aerial sur-

veys were initiated 20 September and originated from the Naval Arctic Research Laboratory. Flights were made east and west of Barrow, AK along the coast, as well as over offshore areas extending out to the edge of the pack ice approximately 15-20 miles from shore. Visual estimates were made and photographs taken to verify species identification and numbers of animals seen. (See also W77-06793) (Sinha-OEIS)
W77-06796

THE NATURAL HISTORY AND ECOLOGY OF THE BEARDED SEAL (ERIGNATHUS BARBATUS) AND THE RINGED SEAL (PHOCA (PUSA) HISPIDA),
Alaska Dept. of Fish and Game, Fairbanks.
T. J. Eley, and J. J. Burns.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 55-124, November 1976. 6 tab, 4 ref, 4 append. 02-5-022-53.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Distribution patterns, *Mammals, Ecology, Biology, Pathology.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, Bering Sea, *Beaufort Sea, *Chukchi Sea, Phocidae, Pinnipedia, Biological collections.

The objectives of this investigation were to provide a summarization and evaluation of existing literature and available unpublished data on reproduction, distribution, abundance, food habits and human dependence on bearded and ringed seals in the Bering, Chukchi and Beaufort Seas, and to assure the acquisition of large amounts of specimen material required for an understanding of food habits in these two species, and the acquisition of additional data of productivity and growth rates. Major efforts in this quarter were devoted to field activities. One hundred and sixty-three ringed seals and 99 bearded seals were obtained or collected. Measurements, jaws, claws, stomachs and reproductive tracts were obtained from most specimens. Analysis of reproduction and growth is critically dependent on accurate determination of the age of specimens. Although a number of measurements have been made age data is not yet available from enough individuals to allow meaningful analysis. A draft report of Marine Mammal Diseases and Parasites by Carol A. Nielson is included as Appendix 4 of this report. (See also W77-06793) (Sinha-OEIS)
W77-06799

AN AERIAL CENSUS OF SPOTTED SEALS, PHOCA VITULINA LARGHA,
Alaska Dept. of Fish and Game, Fairbanks.
J. J. Burns, and S. J. Harbo, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 125-26, November 1976. 03-5-022-53.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Mammals, Sea ice.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Seals (Spotted), *Bering Sea, Seasonal distribution, Phoca vitulina largha.

Determination was made of the seasonal density and distribution of spotted seals, Phoca vitulina largha, in the ice front of eastern Bering Sea. During later winter and early spring, this seal occurs in considerable numbers, within the proposed Bristol Bay, St. George Basin and Navarin Basin lease areas. All data collected have been transcribed from field record forms to computer forms. These

forms have been keypunched and verified. (See also W77-06793) (Sinha-OEIS)
W77-06800

IDENTIFICATION, DOCUMENTATION, AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA,
Alaska Dept. of Fish and Game, Fairbanks.
P. D. Arneson.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 170-196, November 1976. 10 fig, 6 tab. 03-5-022-69.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Migratory birds, Birds, Habitats, Littoral, Estuaries.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Gulf of Alaska, *Bristol Bay, *Beaufort Sea, *Chukchi Sea.

The objectives of this investigation were to summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of birds associated with littoral and estuarine habitat in the Gulf of Alaska, Bristol Bay, Beaufort Sea and Chukchi Sea, and on barrier islands in the Beaufort Sea. Other objectives were to determine seasonal density distribution, critical habitats, migratory routes, and breeding locales for principal bird species in the study area and identify critical species particularly in regard to possible effects of oil and gas development. The technique used for shoreline bird surveys was flying in single-engine, high wing aircraft at an altitude of approximately 30-45 meters and speed of 160 kilometers per hour. Observers were used on both sides of the aircraft. All observations were recorded on cassette-type tape recorders. It was determined that southern Bristol Bay is a very important summering area for birds. The regions surveyed represent only a small portion of the southern Bering Sea area. (See also W77-06793) (Sinha-OEIS)
W77-06804

IDENTIFICATION, DOCUMENTATION, AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA, AND THE DISTRIBUTION, ABUNDANCE AND FEEDING ECOLOGY OF BIRDS ASSOCIATED WITH PACK ICE,
Alaska Dept. of Fish and Game, Fairbanks.
G. J. Divoky.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 197-215, November 1976. 1 fig.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Migratory birds, Sea ice, Distribution patterns.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea, *Pack ice.

Aerial censusing was the primary means of obtaining information on bird use of coastal waters. Transects along the coast were walked in order to determine numbers and activities of species using inshore waters, adjacent beach and tundra. Observations were also made on shipboard while underway. All birds within a 300 m wide transect were counted. Detailed ice observations were made during each transect and the activities of birds in relation to ice were noted. Preliminary results for the cruises in the Bering Sea indicate that the greatest concentrations of birds seen on the Surveyor cruise were in the leads and polynias of the ice

over the continental shelf. These ice openings had densities averaging over 600 birds per square kilometer and ranged up to 8000 birds per square kilometer. Lower concentrations were found immediately south of the ice edge. Much lower densities were characteristic of Bering Sea waters with depths greater than 200 meters. (See also W77-06793) (Sinha-OEIS)
W77-06805

ECOSYSTEM DYNAMICS BIRDS AND MARINE MAMMALS. PART I: PRELIMINARY ESTIMATES OF PINNIPED - FINFISH RELATIONSHIPS IN THE BERING SEA,
National Marine Fisheries Service, Seattle, Wash.
Northwest Fisheries Center.
W. B. McAlister, and M. A. Perez.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 219-248, November 1976. 4 fig, 11 tab, 26 ref.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Ecosystems, *Trophic levels, Mammals, Fish, Birds, Food habits.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea, Pinnipedia.

Studies reported represent the results of research proposed to integrate and synthesize data into a conceptual submodel of the ecosystem describing tropho-dynamic relationships in the eastern Bering Sea including interactions among northern fur seals, other marine mammals, marine birds, and several species of fish. The amount of food consumed by fur seals and other pinnipeds has been estimated and compared with the amount of fish caught by commercial fisheries in the same waters. Although this report is preliminary and the first step in a detailed process of analyzing all known data on the feeding relationships of pinnipeds, it does appear to provide a good estimate of the range of finfish consumption by fur seals and other pinnipeds. (See also W77-06793) (Sinha-OEIS)
W77-06806

ECOSYSTEM DYNAMICS BIRDS AND MARINE MAMMALS. PART II: FOOD WEB STRUCTURE AND TROPHIC RELATIONS OF BERING SEA AVIFAUNA (PRELIMINARY REPORT),
National Marine Fisheries Service, Seattle, Wash.
Northwest Fisheries Center.
G. A. Sanger.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 249-263, November 1976. 2 fig, 6 tab, 11 ref.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Birds, *Food habits, *Food webs, Population.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea, Trophic relationships, Feeding behavior, Uria spp., Puffinus tenuirostris, Seasonal distribution.

This report summarizes published and unpublished information on population sizes, seasonal changes in distribution and abundance, and feeding behavior and food habits of murres (Uria spp.) and short-tailed shearwaters (Puffinus tenuirostris) in the eastern Bering Sea. This report is largely a compilation of basic information in tabular form. (See also W77-06793) (Sinha-OEIS)
W77-06807

ECOSYSTEM DYNAMICS BIRDS AND MARINE MAMMALS. PART III: A DYNAMIC NUMERICAL MARINE ECOSYSTEM MODEL FOR EVALUATION OF MARINE RESOURCES IN EASTERN BERING SEA,
National Marine Fisheries Service, Seattle, Wash.
Northwest Fisheries Center.
T. Laevastu, F. Favorite, and W. B. McAlister.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 264-377, November 1976. 24 fig, 6 tab, 12 ref, append.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Model studies, Ecosystems.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea, Numerical models, Food availability.

The objective of this project is to design and program a complete marine ecosystem model for quantitative evaluation of: the effects of man, environmental changes (anomalies), and interspecies interactions on the dynamics of marine ecosystem, with emphasis on economically important species. The concept and design of Dynamical Numerical Marine Ecosystem Model (DYNUMES) is described and results obtained from an 8-component version of the model are presented. The use and utility of the DYNUMES model is tested and results indicated several phenomena within the ecosystem that have received little attention in the past research, but which seem to be among major determinants of the balance within the system. One of the general conclusions from the use of the model is that availability of food is a limiting factor for most ecological levels and groups. (See also W77-06793) (Sinha-OEIS)
W77-06808

REPRODUCTIVE ECOLOGY OF PRIBILOF ISLAND SEABIRDS,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
G. L. Hunt, Jr.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 378-387, November 1976. 1 fig. 03-5-022-72.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Birds, Ecology, Reproduction, Population, Phenology, Food habits.
Identifiers: *Outer Continental Shelf, *Pribilof Islands, Bering Sea, Environmental assessment, Environmental impact.

Objectives of this investigation were: to determine the phenology of seabirds nesting on St. Paul and St. George Islands; to evaluate reproductive success of seabirds nesting on St. Paul and St. George Islands; to determine food habits of Pribilof Island Seabirds; to conduct radial transects by ship in the vicinity of St. Paul and St. George Islands; and to aid in the estimation of population size of Pribilof Island seabirds. Results suggest that most alcid forage fairly close to the island where they nest, usually within 10 nautical miles. Tufted and Horned Puffins may travel further off shore. Cormorants forage close to their islands. Fulmars appear to move far off shore, and black-legged kittiwakes may forage in large flocks in tide-rips near the ends of their nesting islands. (See also W77-06793) (Sinha-OEIS)
W77-06809

COMMUNITY STRUCTURE, DISTRIBUTION, AND INTERRELATIONSHIPS OF MARINE BIRDS IN THE GULF OF ALASKA,
Oregon State Univ., Corvallis. Dept. of Zoology.
J. A. Wiens.

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 391-403, November 1976. 03-5-022-68.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Water pollution, *Water birds, *Birds, *Ecosystems, *Populations.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Gulf of Alaska.

Patterns of seasonal abundance and distribution were studied because of their direct relevance to oil development and transport activities, and also to use in analysis of marine bird energetic impacts. The dynamics of feeding flocks of seabirds were investigated to determine the degrees and directions of dependency and/or interference between seabird species. This involves a description of the roles of different species in flock formation and development and an analysis of their contribution to the efficiency and performance of the system as a whole. Observations were made at all periods of the day but were largely dependent upon weather, visibility and ship's activity. Specimens were collected by shotgun for analysis of food habits. (See also W77-06793) (Sinha-OEIS) W77-06810

SHOREBIRD DEPENDENCE ON ARCTIC LITTORAL HABITATS, California Univ., Bodega Bay. Bodega Marine Lab.

R. W. Risebrough, and P. G. Connors.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 404-408, November 1976.

Descriptors: *Alaska, *Arctic, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Water birds, *Oil pollution, *Shore birds, *Littoral, *Habitats, *Ecology.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, Seasonal variations.

The assessment of the degree and natural dependence of each shorebird species on Arctic habitats which may be susceptible to perturbation from offshore oil development activities entails three major areas of investigation: Seasonal occurrence of shorebirds by species, in a variety of arctic littoral and near-littoral habitats; foraging habitat preferences of shorebirds within the littoral zone, by species; and diets of shorebirds in the arctic littoral zone, by species, as these change through the season. Approximately 500 transect censuses were completed during this period. In general, the timing of movements of shorebirds in littoral areas agreed with the pattern established during the 1975 season, but with several differences, especially in population magnitudes. The most striking difference discovered, however, was the change in plankton composition and density along the gravel shorelines. (See also W77-06793) (Sinha-OEIS) W77-06811

AVIFAUNAL UTILIZATION OF THE OFFSHORE ISLAND AREA NEAR PRUDHOE BAY, ALASKA, Alaska Univ., College. Inst. of Marine Science.

D. Schamel.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 409-447, November 1976. 11 fig, 1 tab, 20 ref, append. 03-5-022-56.

Descriptors: *Alaska, *Migratory birds, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Oil pollution, *Barrier islands, *Water pollution effects, *Population, *Shore birds, *Seasonal, *Ecology.
Identifiers: *Outer Continental Shelf, *Prudhoe Bay, *Egg Island(AK), Environmental assessment, Environmental impact, Common Eiders, King Eiders, Oldsquaw, Somateria mollissima, Somateria spectabilis, Clangula hyemalis.

The objective of the study was to document changes in numbers and activity patterns of avifauna over time and space. Census work was conducted with a 1.8 km radius from an observation blind on Egg Island. Egg Island is a barrier inlet on the Beaufort Sea coast which was found to have the greatest concentration of nesting eiders during a preliminary survey of islands in this area. Mean densities of birds were greatest on 24 June and on 20 July. These figures correspond to the peaks of spring and summer migration, respectively. Spring migration is concentrated almost entirely at sea. The bay is used increasingly by birds from early July through August. The most numerous birds in the area (Common Eiders, King Eiders, and Oldsquaw) are all highly susceptible to oil spills. Since Common Eiders and, to a lesser extent, King Eiders breed on barrier islands, oil development on these islands could interfere with nesting. (See also W77-06793) (Sinha-OEIS) W77-06812

BIRDS OF COASTAL HABITAT ON THE SOUTH SHORE OF SEWARD PENINSULA, ALASKA,

College of the Atlantic, Bar Harbor, Maine.
W. H. Drury.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 448-468, November 1976. 5 tab. 03-5-022-77.

Descriptors: *Alaska, *Shorebirds, *Water birds, *Waterfowl, *Water pollution effects, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Birds, *Coasts, *Habitats, *Population.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Seward Peninsula(Alas).

Studies of populations, community structure and ecology of marine birds at Bluff Cliffs and Sledge Island and surveys of the use of coastal habitats by waterfowl and shorebirds are the objectives of this investigation. Field activities are reported and species number and distribution are down in tables. (See also W77-06793) (Sinha-OEIS) W77-06813

ECOLOGY AND BEHAVIOR OF SOUTHERN HEMISPHERE SHEARWATERS (GENUS PUFFINUS) AND OTHER SEABIRDS, WHEN OVER THE OUTER CONTINENTAL SHELF OF THE BERING SEA AND GULF OF ALASKA DURING THE NORTHERN SUMMER, Calgary Univ., (Alberta).

J. Guzman.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 469-478, November 1976. 2 fig.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Birds, *Distribution patterns, *Ecology, *Weather, *Pollutants.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea, *Gulf of Alaska, Shearwaters, Puffinus tenuirostris, Puffinus griseus.

The degree of overlap in the geographical distribution of the Short-tailed Shearwater (*Puffinus tenuirostris*) and the Sooty Shearwater (*Puffinus griseus*) during the northern summer in the study area, and the relationship between the distribution of these Shearwaters and particular water conditions, the distance from shore, the foods available to them, and the passage of weather systems were studied during the cruise of the DISCOVERER. (See also W77-06793) (Sinha-OEIS) W77-06814

SEASONAL DISTRIBUTION AND ABUNDANCE OF MARINE BIRDS,

Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and J. C. Bartonek.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 479-484, November 1976. 1 tab. 01-5-022-2538.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Population, *Birds, *Surveys, *Water pollution, *Seasonal, *Coasts, *Ecosystems, *Leases.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Gulf of Alaska, *Bering Sea, Arctic Ocean.

The objective of this research unit was to describe the seasonal density distribution of marine birds in those portions of the Gulf of Alaska, the Bering Sea, and the Arctic Ocean that have been identified by the U.S. Department of the Interior for leasing and development of their oil and gas potentials. This research considered only the offshore environment and did not include species generally confined to the nearshore and littoral habitats. It did not directly consider the distribution of pelagic species when they occupy shoreline habitats such as during the breeding season. Effort continued during this quarter to bet shipboard survey data into a form useable for automatic data processing. (See also W77-06793) (Sinha-OEIS) W77-06815

PRELIMINARY CATALOG OF SEABIRD COLONIES AND PHOTOGRAPHIC MAPPING OF SEABIRD COLONIES,

Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and J. C. Bartonek.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 485-524, November 1976. 21 fig, 2 tab. 01-5-022-2538/01-06-022-11437.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, *Water resources, *Bird, *Distribution patterns, *Population, *Surveys.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bristol Bay(Alas).

This report contains the preliminary catalog of seabird colonies in the Bristol Bay Basin and a summary of other activities during the quarter. The location and relative size of marine bird colonies bounding the Bristol basin are summarized and information is given about their location, composition, size, and amount of land occupied. (See also W77-06793) (Sinha-OEIS) W77-06816

REVIEW AND ANALYSIS OF LITERATURE AND UNPUBLISHED DATA ON MARINE BIRDS,

Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and J. C. Bartonek.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 525-538, November 1976. 01-6-022-11437.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Birds, Bibliographies, Leases. Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bristol Bay Basin(Alas).

A bibliography of source information on bird resources in the Bristol Bay Basin (exclusive of St. George Basin) OCS lease sale area was prepared for the Service's response to the Bureau of Land Management's request for environmental data to be used in their deliberations on tract selection and deletion. (See also W77-06793) (Sinha-OEIS) W77-06817

MIGRATION OF BIRDS IN ALASKA COASTAL AND MARINE HABITATS SUBJECT TO INFLUENCE BY OCS DEVELOPMENT,

Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and J. C. Bartonek.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 539-541, November 1976. 01-6-022-11437.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Birds, Migratory birds, Migrations, Habitats.

Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact.

This report is a summary of efforts mainly during the quarter by U.S. Fish and Wildlife Service personnel, contractors, and collaborators to characterize the migration of birds in those Alaskan waters subject to petroleum development of the outer continental shelf. Information is presented on banding efforts, recent reports of sightings of banded birds, sea watch efforts, and a report of bird migration past Pt. Barrow during the fall of 1975. (See also W77-06793) (Sinha-OEIS) W77-06818

FEEDING ECOLOGY AND TROPHIC RELATIONSHIPS OF ALASKAN MARINE BIRD, AND POPULATION DYNAMICS OF MARINE BIRDS,

Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and J. C. Bartonek.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 542-553, November 1976. 3 tab. 01-5-022-2538.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Ecology, Birds, Food habits. Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, Population dynamics, Trophic relationships, *Gulf of Alaska, *Bering Sea.

Research Units RU 341 and 342 were designed to help satisfy the objectives which are to describe the trophic relationships and the population dynamics of selected species at offshore and coastal study sites. Since personnel, coastal study sites and ships, are largely identical the two research units are treated together in this report. Activities under these two units were largely restricted to the Gulf of Alaska and the southeastern Bering Sea. Most study sites were selected because of the dominant species present, their unique habitat, and the potential vulnerability of the locality to impact from OCS activities. Information on both trophic relationships and population dynamics were collected at most of these sites. Birds were collected during 4 cruises and at 14 field sites for determination of food habits. (See also W77-06793) (Sinha-OEIS) W77-06819

AVIAN COMMUNITY ECOLOGY AT TWO SITES ON ESPENBERG PENINSULA IN KOTZEBUE SOUND, ALASKA. A COMPOSITE STUDY OF: (1) HABITAT UTILIZATION AND BREEDING ECOLOGY OF WATERBIRDS, (2) HABITAT UTILIZATION AND BREEDING ECOLOGY OF SHOREBIRDS AND NON-WATERBIRD SPECIES, AND (3) HABITAT UTILIZATION, BREEDING ECOLOGY, AND FEEDING ECOLOGY OF PREDATORS OF BIRDS,

Alaska Univ., College. Inst. of Arctic Biology.

D. Schamel, D. Tracy, and A. Jonson.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 554-576, November 1976. 2 fig, 3 tab. 03-5-022-56.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Birds, *Waterfowl, Habitats, Breeding, Ecology, Phenology, Shore birds.

Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Kotzebue Sound(Alas).

As a result of field activities to evaluate avian activities in Kotzebue Sound, a list of 68 species of birds seen on Cape Espenbert in 1976 and the breeding status of each is given. Those birds listed as 'common' nesters were abundantly breeding throughout the Cape. 'Moderate' nesting species were either found in moderate breeding densities throughout the Cape or were locally abundant only. When only a few nests of a species were found, the bird was given the 'uncommon' status. 'Probable' nesters are those species that established and defended territories or acted 'broody' but for which neither nests nor broods were found. All other birds were placed in the 'not nesting' category. The complete results of the banding operation is also presented. (See also W77-06793) (Sinha-OEIS) W77-06820

STUDIES OF POPULATIONS, COMMUNITY STRUCTURE AND COLONY OF MARINE BIRDS AT KING ISLAND, BERING STRAIT REGION, ALASKA,

College of the Atlantic, Bar Harbor, Maine.

W. H. Drury.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 577-585, November 1976. 03-6-022-35208.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Birds, Population, Ecology, Breeding, Phenology.

Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea.

The objectives were to determine the number and distribution of each species relative to other species, to periods of the breeding season, and to characteristics of available habitat within the colony or study area. Other objectives were to provide estimates of nesting success of principal species, to determine the amount and kinds of foods utilized by the principal species, and to describe the chronology and phenology of events in the biology of breeding birds, including changes in population from the beginning of site occupation in the spring through departure in the fall. Seven study sites were established and three air transect routes were followed in the SE Chirikov Basin and five surface transect routes were followed. A preliminary synthesis of data and interpretation is given. (See also W77-06793) (Sinha-OEIS) W77-06821

AVIAN COMMUNITY ECOLOGY OF THE AKULIK - INGLUTALIK RIVER DELTA, NORTON BAY, ALASKA,

Alaska Univ., College. Inst. of Arctic Biology.

G. F. Shields, and L. J. Peyton.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 586-588, November 1976. 03-5-022-56.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Ecology, Populations, Distribution patterns, Breeding.

Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Norton Bay(Alas).

The objectives of the investigation were to define the ecology community structure and populations of marine birds of the Akulik - Inglutalik Data area, Norton Bay, Alaska. Field data was obtained on the numbers and distribution of the birds utilizing the study area, their nesting density, their clutch sizes, and their hatching success. (See also W77-06793) (Sinha-OEIS) W77-06822

A COMPARATIVE SEA-CLIFF BIRD INVENTORY OF THE CAPE THOMPSON VICINITY, ALASKA,

D. G. Rose, and A. M. Springer.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 589-593, November 1976. 1 ref. 03-6-022-35210.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Birds, Habitats, Breeding, Population, Ecology.

Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Sea-cliff birds, Murres, Kittiwakes, Puffins, Gulls, *Cape Thompson(Alas), Cape Lisburne.

This report provides information on field activities and laboratory activities on the sea cliff birds (murres, black-legged kittiwakes, horned puffins, and glaucous gulls) at Cape Thompson and comparisons with bird populations at Cape Lisburne. The murre population at Cape Lisburne was about the same as at Cape Thompson, although breeding appeared to be advanced at Cape Lisburne. Counts of the kittiwakes were not made at Cape Lisburne although reproductive success was noticeably better than at Cape Thompson. It is speculated that the late winter and spring might be one of the factors resulting in poor reproductive success of the kittiwakes at Cape Thompson this year. (See also W77-06793) (Sinha-OEIS) W77-06823

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

CHARACTERIZATION OF COASTAL HABITAT FOR MIGRATORY BIRDS: NORTHERN BERING SEA, Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.

C. J. Lensink, and R. D. Jones, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 594-596, November 1976. 01-6-022-15670.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, *Habitats, *Migratory birds, Intertidal areas, Land use, Ecology, Coasts.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bering Sea.

The area covered by this study extends from Cape Newenham to the Bering Straits and relates most directly to the proposed developments in Norton Sound. The objectives of the study were to: to characterize coastal habitat utilized by marine birds by: describing extent and characteristics of unvegetated intertidal beaches; describing extent and characteristic of intertidal plant communities; identifying the maximum limit of tidal influence of terrestrial habitat by mapping the occurrence of drift lines; identify ownership status (private or public) and responsible land management agency; and identify and quantify existing land uses; and to characterize use of habitat by birds including identification of principal species, identification of habitat use and identifying relative or approximate numbers of birds utilizing habitats seasonally. Primary effort during the quarter was devoted to field studies on the Yukon Delta north and west of Kotlik. (See also W77-06793) (Sinha-OEIS) W77-06824

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PRINCIPAL INVESTIGATORS' REPORTS JULY-SEPTEMBER 1976. VOLUME 2: FISH, PLANKTON, BENTHOS, LITTORAL.

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending September 1976. Vol 2. Fish, Plankton, Benthos, Littoral, November 1976, 535 p.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Environmental effects, Water resources, *Data collections, Aquatic life, Marine fish, Plankton, Aquatic algae, Benthos.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Gulf of Alaska, Bering Sea, Beaufort Sea, Cook Inlet, Kodiak Island.

This volume contains the quarterly reports of baseline studies on the environmental effects related to petroleum development on the Alaskan Continental Shelf. The multi-year program is directed by the National Oceanic and Atmospheric Administration under the sponsorship of the Bureau of Land Management. The baseline studies in this volume encompass fish, plankton, benthos and littoral biota. (See W77-06826 thru W77-06849) (Sinha-OEIS) W77-06825

THE DISTRIBUTION, ABUNDANCE, DIVERSITY AND PRODUCTIVITY OF BENTHIC ORGANISMS IN THE BERING SEA, Alaska Univ., College. Inst. of Marine Science. H. M. Feder.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 1-5, November 1976. 03-5-022-56.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Environmental effects, Water resources, *Benthos, *Aquatic populations, *Ecosystems, *Ecology, Data collections, Leases, Oil industry.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Bering Sea, Resource availability, Oil lease sites.

Objectives of the study were to make qualitative and quantitative census of dominant species within oil lease sites and to provide descriptions of seasonal and spatial distribution patterns, with emphasis on assessing patchiness and correlation with microhabitat. Comparisons of species distribution with physical, chemical and geological factors were to be made and observations of biological interrelationships in benthic biota of the study area were to be documented. A selected set of stations from the cruise of the R/V DISCOVERER in 1975 have been processed by the Marine Sorting Center. This data has been keypunched, and analysis, inclusive of cluster analysis, will take place when 60 selected stations on the MB grid have been completely processed. (See also W77-06825) (Sinha-OEIS) W77-06826

SPAWNING HERRING SURVEYS IN THE BERING SEA AND FINFISH RESOURCE SURVEYS IN NORTON SOUND AND KOTZEBUE SOUND, Alaska Dept. of Fish and Game, Anchorage. Div. of Commercial Fisheries.

L. H. Barton.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending September 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 41-102, November 1976. 3 fig, 3 tab, append.

Descriptors: Water resources, *Fish populations, *Alaska, *Spawning, *Data collections, *Fish migration, *Baseline studies, *Resources development, *Water pollution effects, *Environmental effects, Distribution patterns, Herrings, Salmon.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Bering Sea, Norton Sound, Kotzebue Sound, Finfishes, Geographic distribution, Capelin, Fishery resources, Resources availability.

The progress of activities extending through September 30, 1976 for two OCS Research Units are reported. The objectives of these research units were to: determine the spatial and temporal distribution, species composition and relative abundance of finfishes in the coastal waters of Norton Sound and Kotzebue Sound east of 166°W longitude; determine the timing and routes of juvenile salmon migrations as well as examine age and growth, relative maturity and food habits of important species in Norton Sound and Kotzebue Sound east of 166°W longitude; determine the spatial and temporal distribution and relative abundance of spawning populations of herring and capelin from Unimak Pass to Point Hope; monitor egg density, distribution and development and document types of spawning substrates of herring and capelin; and monitor the subsistence utilization of fishery resources by local residents. An appendix written by Irving M. Warner and Pamela M. Shafford reports on the field activities and laboratory activities for the forage fish spawning surveys from Unimak Pass to Ugashik River. (See also W77-06825) (Sinha-OEIS) W77-06828

PELAGIC AND DEMERSAL FISH ASSESSMENT IN THE LOWER COOK INLET ESTUARY SYSTEM, Alaska Dept. of Fish and Game, Kodiak. J. E. Blackburn.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 103-113, November 1976. 2 fig, 3 tab.

Descriptors: Water resources, *Alaska, *Data collections, *Baseline studies, *Meteorological data, *Fish populations, *Resource development, *Environmental effects, *Distribution patterns, Migrations, Spawning, Estuaries.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Pelagic fish, Demersal fish, Cook Inlet, Fish assessment.

Activities, progress and some preliminary results on Cook Inlet Pelagic and Demersal Fish Studies from July through September 1976 are reported. The study area for this project includes lower Cook Inlet from the Forelands to 59°N latitude and west of 152°W longitude, south of Pt. Bede on the Kenai Peninsula. Some objectives of this project were to: determine the spatial and temporal (May-September) distribution, relative abundance and inter-relationships of the various pelagic and demersal finfish and shellfish species in the study area; determine when, where, at what rate and in what relative abundance pelagic fish species (primarily salmonids) migrate into and through the study area; and determine the growth rate and food habits of selected pelagic and demersal fish species. (See also W77-06825) (Sinha-OEIS) W77-06829

RAZOR CLAM (SILIQUA PATULA, DIXON) DISTRIBUTION AND POPULATION ASSESSMENT STUDY.

Alaska Dept. of Fish and Game, Kodiak. Div. of Commercial Fisheries.

R. J. Kaiser, and D. Konigsberg.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 115-162, November 1976. 15 fig, 8 tab. 03-5-022-69.

Descriptors: Water resources, *Alaska, *Clams, *Distribution patterns, *Baseline studies, *Resource development, *Environmental effects, Data collections, Beaches, Sediment, Ecology, Intertidal areas.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Population assessment, Substrates, Pacific razor clam, Siliqua patula.

Specific objectives of this study were to gather information of bivalve density, distribution, age and growth (razor clams only), and habitat on beaches from Yakutat Bay at 139 degrees west longitude to Unimak Bight on the Alaska Peninsula. Nine sandy beach areas were investigated and each organism's location was identified with regard to the extent of the species' existence, density, and habitat. Bivalves were collected and identified at each location and density, length, and age composition was assessed. Core samples were collected at each base site to investigate substrate composition and grain size. Severe weather conditions proved to be the limiting factor in terms of the amount of work accomplished. (See also W77-06825) (Sinha-OEIS) W77-06830

RESOURCES OF NON-SALMONID PELAGIC FISH OF THE EASTERN BERING SEA AND THE GULF OF ALASKA, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center. W. T. Pereyra, and M. O. Nelson.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 173-251, November 1976. 2 fig, 1 tab. R7120811 and R7120812.

Descriptors: Fishes, *Alaska, *Bibliographies, *Baseline studies, Water resources, *Resources development, *Environmental effects, Distribution patterns, Abundance, Populations.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Pelagic fish, *Bering Sea, *Gulf of Alaska, Fishery resources, Life histories, Resource availability.

In spite of difficulties encountered during the quarter, a nine track magnetic computer tape containing all non-proprietary data pertaining to sampling and catches of nonsalmonids under study was provided. A report describing the data record, methods of data acquisition, reliability and accuracy estimates, and evaluation of individual records was given. This report consists chiefly of an annotated bibliography of 208 references and abstracts containing information on pelagic fish within the target areas. The abstracts are arranged alphabetically by author and data and are cross indexed according to subject matter and general geographic area. Individual species were selected for inclusion in the bibliography on the basis of their prominence in the catches of both United States and foreign commercial fishing fleets, their relative abundance in research vessel catches indicating potentially latent resources, and/or their prominence in the provision and maintenance of ecological balance as major predators, competitors, or forage fish. The final list of species includes 15 families and more than 22 individual species. (See also W77-06825) (Sinha-OEIS)
W77-06832

BASILENE/RECONNAISSANCE CHARACTERIZATION, LITTORAL BIOTA, GULF OF ALASKA AND BERING SEA.
National Marine Fisheries Service, Auke Bay, Alaska. Auke Bay Fisheries Lab; and National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
S. T. Zimmerman, and T. R. Merrell, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 252-267, November 1976. 1 tab.

Descriptors: *Alaska, Water resources, *Baseline studies, *Resources development, *Habitats, *Data collections, *Environmental effects, Coasts, Biota, Oil industry, Exploration, *Distribution patterns, Populations.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Gulf of Alaska, *Bering Sea.

There were two objectives in this study: to determine the distribution of the major habitat types (sandy, muddy, rocky, etc.) along the coastline; and to determine the densities and distribution of biotic populations within these habitat types. The distribution of habitat was determined by visual reconnaissance methods from fixed wing aircraft. Additional information utilizing aerial photography and multispectral scanning methods was produced in cooperation with NASA and the Environmental Research Institute of Michigan. The distribution of organisms within habitat types was determined by field parties from the Auke Bay Fisheries Laboratory (ABFL), with logistical assistance from the Pacific Marine Center. Additional projects included a study of the accumulation of biotic debris in the 'drift zone,' the estimation of variability between sampling areas, and more intensive studies at a few sites which may receive major impact from oil exploration in the eastern Gulf of Alaska. (See also W77-06825) (Sinha-OEIS)
W77-06833

PLANKTON OF THE GULF OF ALASKA - ICHTHYOPLANKTON.
Washington Univ., Seattle. Dept. of Oceanography.
T. S. English.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 269-303, November 1976. 2 fig, 13 tab. 03-5-022-67-TA No. 4.

Descriptors: *Alaska, Water resources, *Data collections, *Resources development, *Environmental effects, *Distribution patterns, *Baseline studies, Ecosystems, Shrimp, Crabs, Plankton.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Gulf of Alaska, Cook Inlet, Ichthyoplankton, Biological collections, Seasonal distribution, Eggs, Larvae.

The main objective was to conduct a quantitative survey to determine the seasonal distribution of commercially or ecosystem important species of ichthyoplankton and shrimp and crab larvae in Lower Cook Inlet, Alaska. Two cruises were undertaken during the summer of 1976. The first was aboard the University of Alaska research vessel ACOMA, from 8-15 July 1976 while the second was aboard the NOAA ship SURVEYOR, from 24-31 August 1976. Zooplankton and ichthyoplankton were sampled with a bongo net in a double oblique tow. Continuous acoustic surveys were conducted. A summary of taxonomic categories of fish eggs, larvae, young and adults found in Bongo nets samples collected on Lower Cook Inlet on a previous cruise in May 1976 is given. (See also W77-06825) (Sinha-OEIS)
W77-06834

INITIAL ZOOPLANKTON INVESTIGATIONS IN LOWER COOK INLET.
National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
D. M. Damkaer.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 304-314, November 1976. 3 fig, 2 tab.

Descriptors: *Alaska, *Zooplankton, Water resources, *Distribution patterns, *Baseline studies, *Resources development, *Environmental effects, *Data collections, Population, Copepods, Amphipoda, Monitoring, Ecosystems, Seasonal Ecology.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Cook Inlet, Abundance, Euphausiids, Chaetognaths.

The seasonal distribution and abundance of zooplankton in selected areas of the Gulf of Alaska, especially Lower Cook Inlet were determined. Particular attention is given to the distributions of copepods (the most abundant net-plankton and the key grazers), amphipods and euphausiids (important food for fishes), chaetognaths (key carnivores), larval decapods, and some other groups. All major taxa are enumerated as such whether or not the individual species can be identified. This work should lead to development of a monitoring strategy. Also, it will ultimately contribute to an ecosystem model by defining pathways and amounts of energy or material flow and indicating the relative importance of the several populations. (See also W77-06825) (Sinha-OEIS)
W77-06835

PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN THE NORTHEAST GULF OF ALASKA.

National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
J. D. Larrance, and D. A. Tennant.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 315-344, November 1976. 7 fig, 4 tab, 3 ref.

Descriptors: *Alaska, Water resources, *Baseline studies, *Resources development, *Phytoplankton, *Primary productivity, *Environmental effects, *Data collections, Chlorophyll, Nitrates, Distribution patterns.
Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Gulf of Alaska, Prince William Sound, Cook Inlet, Standing stock.

The time succession of primary production, phytoplankton standing stocks and species during the spring in lower Cook Inlet and Prince William Sound were determined. Much of the data has been reduced and listed in tables. Primary productivity and plant pigments are integrated over depth in the upper layers and daily totals of incident radiation are listed. Nitrate concentrations were selected for discussion because they are most often the critical of the plant nutrients when nutrient limitation of primary production occurs. At most stations, chlorophyll a concentrations and primary production increased between early April and late May, maintained a high level through early July, then decreased to near the early April level by late August. (See also W77-06825) (Sinha-OEIS)
W77-06836

THE MAMMALIAN AND FISH FAUNA OF THE NATURE PRESERVE OF MARTELY, (IN HUNGARY).
I. Sterbetz.
Allattani Kozl 62(1-4), p 107-114, 1975.

Descriptors: *Wildlife, *Flood protection, *Environmental effects, *Ecosystems, *Preservation, Mammal groupings, Fish, Dams, Ecotypes, Rivers, Ecology, Forests, Grasslands, Inlets.
Identifiers: *Hungary(Martely), Nature preserve.

Modern flood protection techniques are slowly modifying the botanically and zoologically significant biotope created by the flood dams built on both banks of the Tiza river near Hodmezovasarhely (Hungary) in the late 19th century which contains willow, poplar and oak forests, meadows, inlets and deep depressions. This is why the 2565 ha, 10 km long region was placed under protection in 1952. Notes based on observations of 27 families of mammals and fish between 1947 and 1974 are presented.—Copyright 1976, Biological Abstracts, Inc.
W77-06838

BASILENE STUDIES OF FISH AND SHELLFISH RESOURCES OF NORTON SOUND AND THE SOUTHEASTERN CHUKCHI SEA.

National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
R. J. Wolotira, Jr., and W. T. Pereyra.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 355-359, November 1976. R7120802.

Descriptors: *Alaska, *Baseline studies, Water resources, *Resources development, *Data collections, *Environmental effects, Fish, Shellfish, Population, Distribution patterns.

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Norton Sound, *Chukchi Sea, Fishery resources, Demersal fish, Cottidae, Cyclopteridae.

The objectives of this study were to determine the distribution and abundance of fish and shellfish resources in the southern Chukchi Sea and Norton Sound, estimate the productivity, length, weight and age distribution of selected demersal fish and shellfish to develop growth models and to provide a data base against which later changes in these parameters may be compared. Considerable information on demersal and near-surface fish stocks was obtained during Leg I of the FRS MILLER FREEMAN Cruise 76B in Norton Sound and the Chukchi Sea. One hundred seventy-four of the entire survey's 240 demersal trawling sites were examined with bottom trawls during September 1976, completing all scheduled sampling in Kitzebug Sound and the Chukchi Sea as well as most of Norton Sound. In addition to completing the trawl stations, 22 gillnet sets were performed. Nearly 50 tentatively identified fish species were encountered during Leg I. Of the 162 preserved samples over half contained members of the family Cottidae. Most of the remaining samples included specimens of the families Cyclopteridae (snailfishes) and Zoarcidae (eelpouts). (See also W77-06825) (Sinha-OEIS)

W77-06839

BEAUFORT SEA ESTUARINE FISHERY STUDY.

Alaska Dept. of Fish and Game, Fairbanks. Div. of Sport Fish.

T. M. Bendock.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 360-362, November 1976. 03-5-022-69.

Descriptors: *Alaska, *Estuaries, Water resources, *Baseline studies, *Resources development, *Environmental effects, *Data collections, Fisheries, Ecology, Distribution patterns. Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Beaufort Sea, Anadromous fishes.

Field activities during the summer of 1976 were directed towards identifying the migration patterns, timing of movements and seasonal abundances of Beaufort Sea fish in the vicinity of Prudhoe Bay and along the Beaufort Sea coast and barrier islands westward to the Colville River. Thirty sampling and recapture stations were monitored along the westward coastal area and barrier islands and two stations were monitored in the lower Sagavanirktok River. Other tasks include identifying critical habitats including spawning, overwintering, feeding, rearing and migration areas; determining the interrelationship of Arctic fishes to lower food-web organisms; and determining the present rate of exploitation of the anadromous fishes of the area and monitoring changes in this usage as development of the area's petroleum resource progresses. (See also W77-06825) (Sinha-OEIS)

W77-06840

THE DISTRIBUTION, ABUNDANCE, DIVERSITY, AND PRODUCTIVITY OF BENTHIC ORGANISMS IN THE GULF OF ALASKA.

Alaska Univ., College. Inst. of Marine Science.

H. M. Feder.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 363-415, November 1976. 13 fig, 4 tab, 28 ref, append. 03-5-022-56.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Benthos,

*Environmental effects, *Distribution patterns, *Productivity, Data collections, Ecosystems, Biota.

Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Gulf of Alaska, Epibenthic biota.

A preliminary, but detailed, examination of the trawl data collection in the north Pacific on the M/V NORTH PACIFIC in the summer of 1975 was made. This assessment of data was included in a paper presented at the Alaska Science Conference in August 1976; the manuscript is attached as an appendix. A qualitative and quantitative inventory census of dominant epibenthic invertebrates was examined from the northeast Gulf of Alaska. Subsequent taxonomic analysis delineated 168 species with the molluscs, crustaceans and echinoderms dominating in species representation with 47, 42, and 36 species taken respectively in each group. Molluscs were represented by 28 families. A description of the spatial patterns of selected species is presented with emphasis on assessing patchiness and correlation with habitat. (See also W77-06825) (Sinha-OEIS)

W77-06841

FOOD AND FEEDING RELATIONSHIPS IN THE BENTHIC AND DEMERSAL FISHES OF THE GULF OF ALASKA AND BERING SEA.

Alaska Univ., College. Inst. of Marine Science.

R. L. Smith.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 418-425, November 1976. 03-5-022-56.

Descriptors: *Alaska, *Benthos, *Baseline studies, *Resources development, Water resources, *Environmental effects, Data collections, Food, Feeding habits, Ecology, Computer programs. Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Bering Sea, *Gulf of Alaska, Demersal fish.

Tasks for this quarter included a continuation of very limited archival procedures on recently acquired Bering Sea samples, completion of preliminary sorts on five target species and devising a computer program for analysis of data. Laboratory activities were centered around completing gut analyses for the three Gulf of Alaska species and two Bering Sea species. (See also W77-06825) (Sinha-OEIS)

W77-06842

RECONNAISSANCE CHARACTERIZATION OF LITTORAL BIOTA, BEAUFORT AND CHUKCHI SEAS.

Western Washington State Coll., Bellingham.

A. C. Broad.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 437-455, November 1976. 1 tab. 03-5-022-81.

Descriptors: *Alaska, *Baseline studies, *Aquatic life, *Resources development, *Environmental effects, Water resource, Data collections, Surveys, Littoral, Biota, Coasts. Identifiers: *Outer Continental, *Environmental assessment, *Environmental impact, *Beaufort Sea, *Chukchi Sea, Biological collections, Arctic, Environmental survey.

The shoreline of the Beaufort Sea is unconsolidated and is comprised largely of pebble or sand and pebble beaches. There is virtually no shoal water or intertidal attached macrobenthos, but there sometimes are large numbers of smaller, invertebrates (mainly annelid worms) in the bottom sediments, and there are nearly always very large numbers of amphipods present everywhere. At depths in excess of 2 m in the lagoons as well as

in the sea bivalve molluscs are common and polychaete worms are virtually ubiquitous. The Arctic littoral ecosystem receives significant contributions from the essentially terrestrial vegetation of beaches and tundra banks and is inseparable from it. Periodic wind-induced fluctuations in local sea level result in inundation of much of the low-lying land. The plant communities in these marshy areas are affected by the sea and are also important in the feeding of geese. The degree to which the Arctic littoral is a detritus-based ecosystem bears further study. (See also W77-06825) (Sinha-OEIS)

W77-06843

ICHTHYOPLANKTON OF THE EASTERN BERING SEA.

National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

F. Favorite, and K. D. Waldron.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 483-486, November 1976. 1 fig.

Descriptors: *Plankton, *Baseline studies, *Alaska, *Resources development, *Environmental effects, *Larvae, Water resources, Data collections, Surveys. Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, Ichthyoplankton, Biological collections, *Bering Sea, Theragra chalcogramma, Teinhardtia hippoglossoides, Atheresthes stomias, Hippoglossus stenolepis.

Ichthyoplankton samples from a portion of the eastern Bering Sea were collected and analyzed. Ichthyoplankton from the 505 bongo and the neuston samples were received at the Northwest Fisheries Center during the first week of September and identification was begun. The samples were from the continental slope west of the Pribilof Islands and from one station near Unimak Pass. The predominant species from these stations was walleye pollock. Larvae of other fish of commercial importance includes those of Greenland turbot, arrowtooth flounder, and Pacific halibut. Capture of halibut larvae is of interest because they have been reported infrequently from the eastern Bering Sea. (See also W77-06825) (Sinha-OEIS)

W77-06845

ASSESSMENT OF PELAGIC AND NEARSHORE FISH IN THREE BAYS ON SOUTHEAST KODIAK ISLAND.

Washington Univ., Seattle. Fisheries Research Inst.

C. K. Harris, and A. C. Hartt.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 487-510, November 1976. 3 fig, 5 tab.

Descriptors: *Alaska, *Fishes, *Baseline studies, Water resources, *Resources development, *Data collections, *Environmental development, Ecology, Distribution patterns, Migrations, Surveys, Bays. Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Kodiak Island (Alas), Stock assessment.

This quarterly progress report covers the last two sampling sessions of the pelagic and nearshore fish survey of Ugak, Kaiugnak, and Aliak bays on southeast Kodiak Island, Alaska. One of the findings of the study is that while all three bays have numerous species in the pelagic zone, only a few are regularly abundant. Capelin, sandfish, and to a lesser extent sandlance and pink salmon comprise a major fraction of the pelagic fish community. Almost all species in the pelagic zone were

Ecologic Impact Of Water Development—Group 6G

overwhelmingly represented by larval or juvenile stages which suggests that the pelagic areas of the bays are nursery areas for fish which reside as adults in benthic, littoral, or oceanic habitats. There are indications of patchy or localized distributions within the study area. The pink salmon especially, deserves special mention in this regard because of their immense economic importance to the Kodiak region. (See also W77-06825) (Sinha-OEIS)
W77-06846

DEMERSAL FISH AND SHELLFISH ASSESSMENT IN SELECTED ESTUARY SYSTEMS OF KODIAK ISLAND,

Alaska Dept. of Fish and Game, Kodiak.
J. E. Blackburn.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 511-520, November 1976. 5 fig, 1 tab.

Descriptors: *Alaska, *Fishes, *Shellfish, *Distribution patterns, *Baseline studies, *Resources development, *Environmental effects, Water resources, Data collections, Surveys, Ecology.

Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Kodiak Island(Alas), Stock assessment, Demersal fish.

This report presents the activities and a preliminary statement of results obtained on demersal fish and shellfish assessment from July 1 through September 30, 1976. Catches in both Ugak and Alitak bays consisted almost entirely of crustaceans, flounders, sculpins and cod. There were considerable differences in the catch between the bays. In Ugak Bay the mean total catch was greater in each month. The catch of fish within both Ugak and Alitak Bays tended to be greatest near the mouth and decrease further within the bay. The catch of crustaceans within each bay did not show a trend of abundance along the length of the bay. King crab were virtually never captured in Deadman Bay while they were taken at nearly every other station in Alitak Bay each month. (See also W77-06825) (Sinha-OEIS)
W77-06847

TECHNICAL TRAWL SURVEY OF THE BENTHIC EPIFAUNA OF THE CHUKCHI SEA AND NORTON SOUND.

Alaska Univ., College. O.C.S. Coordination Office.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 521-526, November 1976. 03-5-022-56.

Descriptors: *Alaska, *Baseline studies, *Invertebrates, *Resources development, *Environmental effects, Water resources, Data collections, Surveys, Distribution patterns, Benthos, Biota.

Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Chukchi Sea, *Norton Sound(Alas), Epibenthic invertebrates, Biological collections, Cruise reports.

Enumeration and gravimetric determination of the epibenthic invertebrates of Chukchi Sea and segments of Norton Sound was made on Leg I of MILLER FREEMAN cruise 76-B. Invertebrate data was obtained from 136 stations. Although large concentrations of invertebrates were encountered, no economically important species were found in commercial quantities. The asteroids (sea stars) were the most conspicuous members of the invertebrate biomass with nine species encountered and four species dominating. In addition to the qualitative and quantitative inventory

census of benthic invertebrate epifaunal species, preliminary observations of biological interrelationships between selected segments of the benthic biota was made. (See also W77-06825) (Sinha-OEIS)
W77-06848

THE DISTRIBUTION, ABUNDANCE AND DIVERSITY OF THE EPIFAUNAL BENTHIC ORGANISMS IN TWO (ALITAK AND UGAK) BAYS OF KODIAK ISLAND, ALASKA,

Alaska Univ., College Inst. of Marine Science.

H. M. Feder.

In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 2. Fish, Plankton, Benthos, Littoral, p 527-530, November 1976. 03-5-022-56.

Descriptors: *Alaska, *Benthos, *Distribution patterns, *Ecology, *Surveys, *Invertebrates, Water resources, *Baseline studies, *Resources development, *Environmental effects, Data collections, Biomass, Coasts, Pollutant identification, Bays.

Identifiers: *Outer Continental Shelf, *Environmental assessment, *Environmental impact, *Kodiak Island(Alas).

Invertebrates were identified to the lowest taxon with numbers and weights normally assigned to each taxon. Approximately 95% of the invertebrate biomass and species consisted of *Chioneetes bairdi*, *Paralithodes camtschatica*, *Pandalus borealis* and *Pandalus hypsinotus*. Unidentified organisms were preserved for later identification. Some observations of biological interrelationships between segments of the benthic biota were made, i.e., feeding observations on commercial crab and demersal fishes. Also, reproductive conditions of selected crabs and shrimps were noted. Pollutants were recorded in four stations. (See also W77-06825) (Sinha-OEIS)
W77-06849

A PILOT STUDY ON THE DESIGN OF A PETROLEUM HYDROCARBON BASELINE INVESTIGATION FOR NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA,

National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.

For primary bibliographic entry see Field 5C.

W77-06875

THE NEW YORK BIGHT PROJECT - 1975; STONY BROOK, LONG ISLAND, NEW YORK.

National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.

For primary bibliographic entry see Field 5G.

W77-06876

IMPACT OF OIL SPILLAGE FROM WORLD WAR II TANKER SINKINGS,

Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

For primary bibliographic entry see Field 5C.

W77-06877

PROGRAM DEVELOPMENT PLAN. ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.

National Oceanic and Atmospheric Administration, Washington, D.C.

December 1976. 263 p, 15 fig, 4 tab, 2 append. NOAA-BLM Basic Interagency Agreement No. AA550-BA7-4.

Descriptors: *Alaska, Baseline studies, *Continental Shelf, Legislation, Leases, Resources development, Oil industry, Environmental effects.

Identifiers: *Outer Continental Shelf, *Environmental assessment, Research programs.

This document is the Program Development Plan for the Alaskan Outer Continental Shelf environmental studies being managed by the National Oceanic and Atmospheric Administration (NOAA) for the Bureau of Land Management. Part III describes the goals and objectives for the OCSEA program. Part IV is organized in a logical engineering program sequence including general approach, user needs, sites of work, related work past and present, the types of studies included in the program, considerations in setting priorities, definition of specific tasks, methods for handling, integrating, and synthesizing the data, and finally definitions of the end products or 'deliverables'. Parts V and VI detail the study schedules tied to user needs, and the management structure, established to provide the study products in a usable and timely manner. Appendices provide essential background material on each geographic lease area, and interagency agreements. (NOAA)
W77-06878

GUIDELINES FOR THE PREPARATION OF ENVIRONMENTAL REPORTS FOR FOSSIL-FUELED STEAM ELECTRIC GENERATING STATIONS,

United Engineers and Constructors, Inc., Philadelphia, Pa.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 071. Price codes: A08 in paper copy, A01 in microfiche. Completion Report, November 1976. 166 p, 54 ref. OWRT C-6531(No. 5238)(1).

Descriptors: *Environmental effects, *Thermal power plants, Electric power plants, *Steam, *Fossil fuels, Electric power demand, Electric power production, Waste treatment, Thermal pollution, Air pollution, Operations, Performance, Standards.

Identifiers: *Environmental impact statements.

Described are the many types of information which should be assembled into an Environmental Report (ER) by an Applicant who proposes to construct a fossil-fueled electrical generating unit and who requires a grant, license, permit or approval from a Federal Agency. The resulting ER would serve as the Applicant's input from which the Federal Lead Agency would prepare an Environmental Impact Statement (EIS). The EIS is required by the National Environmental Policy Act of 1969 (NEPA) when a Federal Agency proposes taking a major federal action significantly affecting the quality of the human environment. The report contains the following chapter headings: Introduction to the Project; Need for the Proposed Facility; Major Alternatives Considered for the Project; Project Description; Alternate Design of Plant Facilities; Mitigation Measures of the Project; Project Evaluation Summary; Applicable Licenses, Permits and Approvals; Environmental Impact and Effects of the Project; Adverse Environmental Effects which Cannot Be Avoided; Relationship of Short Term Use of the Environment and Long-Term Productivity; Resources Committed During Plant Construction and Operation; Environmental Effects and Impacts of Alternatives; Consultations, Conferences and Meetings; Appendices; and References.
W77-06918

STATE INFORMATION NEEDS RELATED TO ONSHORE AND NEARSHORE EFFECTS OF OCS PETROLEUM DEVELOPMENT,

D. C. Williams.

NOAA, Office of Coastal Zone Management and Bureau of Land Management Joint Report on State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development, January 1977. 193 p, 5 maps, 3 append.

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

Descriptors: *Resources development, *Baseline studies, *Environmental effects, Water resources, Coasts, Oil industry, State governments, Local governments, Information exchange, Oil pollution.

Identifiers: *Outer Continental Shelf, *Coastal zone management.

The study conducted in cooperation with coastal States in the summer of 1976, by the Bureau of Land Management, and the Office of Coastal Zone Management, NOAA provides useful information for local, State and Federal officials, the petroleum and offshore development industries, and other groups. There are three sections: The National Analysis, derived from the responses of 22 States, was designed to array nationally significant OSC related State information needs within the context of the States' OCS policies and concerns, current information and State-local relationships in OCS impact planning; The Regional Analysis section identified the findings on specific information needs and variations of the five OCS leasing regions covered by the study; and the Conclusions were drawn from the study findings. Recommendations were made for responsive actions by Federal and State agencies, industry and other interested groups. Appendices include the summaries of the individual State responses, the framework documents of the study and a list of the attendees of the meetings with the States. (NOAA) W77-06934

WHO'S MINDING THE SHORE. A CITIZENS' GUIDE TO COASTAL MANAGEMENT, Natural Resources Defense Council, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W77-06935

COASTAL FACILITY GUIDELINES: A METHODOLOGY FOR DEVELOPMENT WITH ENVIRONMENTAL CASE STUDIES ON MARINAS AND POWER PLANTS, National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
Working Paper, August 1976. 161 p, 4 append.

Descriptors: Coasts, *Florida, Maryland, Marinas, Powerplants, Resources development, Facilities, *Environmental effects, Water pollution effects, Ecosystems.

Identifiers: Coastal zone management, Guidelines, Environmental impact.

This report provides state coastal zone management (CZM) agencies with information and recommendations for developing guidelines for facility development in the coastal zone. Section A of the report presents a methodology for identifying and initiating implementation procedures for management recommendations for specific facility types. Section B and C apply the methodology to marinas and power plants in the states of Florida and Maryland, respectively. The two case studies from Florida and Maryland serve the dual purpose of (1) providing a useful CZM reference source on environmental mitigation techniques and relevant Federal authorities for the two facility types and (2) further clarifying the format, intended information content, and applications envisioned in the methodology. (NOAA) W77-06936

COASTAL ZONE MANAGEMENT, AN-NOTATED BIBLIOGRAPHY, National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
For primary bibliographic entry see Field 2L.
W77-06937

ENVIRONMENTAL POLLUTION: IS THERE ENOUGH PUBLIC CONCERN TO LEAD TO ACTION, Illinois Univ. at Urbana-Champaign.
N. C. Sharma, J. E. Kivlin, and F. C. Fliegel.
Environment and Behavior, Vol. 7, No. 4, December 1975, p 455-471. 1 fig, 1 tab, 21 ref.

Descriptors: *Water quality, *Attitudes, *Social aspects, *Decision-making, *Information exchange, *Political aspects, *Environmental quality, *Illinois, *Social participation, Pollution, Employment.

Identifiers: *Public participation, *Communication channels, Socio-economic status.

A town of 3,000 inhabitants, located in northern Illinois, was studied to discover the extent to which the public was informed, what the public thought of alternative solutions, and generally, the problem solving process in the community when faced with a severe pollution problem. A large meat packing plant was polluting the river which ran through the town. Employing 400 people, it was the most important employer in the town. Pollution attitudes of the residents were analyzed to determine which groups were willing to accept the pollution or were willing to accept the economic consequences of closing the plant. Forty-two percent of the survey respondents favored closing the industry, 58% chose to accept the current pollution level. A 4 stage causal model is presented relating attitudes toward pollution with a number of variables, among which were socioeconomic status, age, length of residence in the community, communication channel usage, and personal interaction in the community. The first stage found significant positive correlations between the willingness to close the plant and discussion with family and friends (rather than drawing from media information or voting activity), negative attitudes toward pollution, and the higher occupational prestige of the respondent. Older people and young people who have not long resided in the community were more tolerant of pollution than young long-time residents. The results show that the political process and involvement in it are not effective in generating anti-pollution sentiment. Reliance on discussion with family and friends to generate anti-pollution sentiment suggests that a grass-roots movement may eventually emerge to combat pollution. (Gentry-North Carolina) W77-06955

ENERGY DEVELOPMENT: THE ENVIRONMENTAL TRADEOFFS. VOLUME 4: THE BACKGROUND PAPERS, Stanford Research Inst., Menlo Park, Calif.
M. D. Levine, R. V. Steele, and I. W. Yabroff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-250 003. Price codes: A07 in paper copy, A01 in microfiche. Prepared for the U.S. Environmental Protection Agency, Washington, D.C., Office of Planning and Evaluation, October 1975. 122 p, 12 fig, 28 tab. 68-01-2469.

Descriptors: *Colorado River Basin, *Missouri River Basin, *Energy, Technology, *Air pollution, *Water pollution, *Social aspects, *Oil shale, Environmental effects, Recycling, Watersheds(Basins).

Identifiers: *Energy development, *Coal liquefaction, *Coal conversion, *Lurgi process, Synthane process.

Background information is presented to provide detailed assessment of selected social and environmental impacts associated with general energy development as well as impacts resulting from specific technology used. A state-of-the-art view of energy conversion technologies is given; e.g., two techniques for increasing production of electricity from western coal are direct burning of coal to produce steam, and low Btu gasification of coal; technologies for increasing liquid fuel supplies are

recovery of oil from shale, coal liquefaction, oil and gas recovery from the outer continental shelf, and gas produced through use of assisted recovery; technologies for producing pipeline gas from coal now involve the Lurgi process; synthane process is promising. The social impacts of energy development in rural areas arise principally due to population increases and urbanization, with subsequent demands for housing, health services and education. Barriers to solving social problems in boom towns are absence of city planners and lack of planning expertise in city councils or other governmental agencies. Effects of energy development on non-energy uses and instream flow levels in the upper Colorado and Missouri River basins appear to be major. Conclusions concerning water quality impacts of oil shale and coal conversion processes are: direct discharge of contaminated water into streams and reservoirs can be minimized by using evaporation ponds, treating and recycling waste water, underground injection of excess water and providing catchment dams. Air pollution varies among conversion technologies and final use of the energy resource. (See also W76-13039) (Gentry-North Carolina) W77-06957

7. RESOURCES DATA

7A. Network Design

COASTAL METEOROLOGICAL NETWORKS TO DETERMINE EFFECTS OF NUCLEAR PLANT COOLING SYSTEMS, Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 2B.
W77-06643

USE OF A PARAMETRIC MODEL AS A TOOL FOR HYDROMETRIC NETWORK PLANNING, Waterloo Univ., (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06710

SURFACE WATER NETWORK DESIGN BY REGRESSION ANALYSIS SIMULATION, Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-06963

7B. Data Acquisition

ROTARY-FLOW TECHNIQUE FOR TESTING FITNESS OF FISH, Uppsala Univ. (Sweden). Inst. of Zoophysiology.
For primary bibliographic entry see Field 5C.
W77-06668

AN APPROXIMATING POLYNOMIAL FOR THE COMPUTATION OF SATURATION VAPOR PRESSURE, Naval Environmental Prediction Research Facility, Monterey, Calif.
For primary bibliographic entry see Field 2B.
W77-06652

A NOTE ON TEMPERATURE AND HUMIDITY PROFILE MEASUREMENT OVER FORESTS USING DIODES, Queen's Univ., Kingston (Ontario). Dept. of Geography.
J. H. McCaughey, and J. I. Walker.
Journal of Applied Meteorology, Vol. 16, No. 1, p 106-109, January 1977. 3 fig, 6 ref.

Descriptors: *Forests, *Vapor pressure, *Temperature, *Humidity, *Canada, Winds,

Agricultural watersheds, Evapotranspiration, Sampling, Instrumentation.
 Identifiers: *Germanium diodes, *Vapor pressure gradients, *Quebec, Humidity profile, Temperature sensors, Sampling array, Temperature profile, Diodes, Dry-bulb temperature, Wet-bulb temperature.

The measurement of accurate air temperature and humidity profiles is fairly routine over agricultural surfaces where the roughness seldom exceeded 2 m in height. In most cases, the sensors are easily accessible, and routine maintenance is simple. Over forests, however, where the roughness elements are several tens of meters in height, accessibility is a major problem, and routine maintenance of the sensors is difficult. A sampling array was described for the measurement of temperature and humidity profiles, using diodes as temperature sensors, above a 15 m balsam fir canopy at Montmorency, Quebec. There were six levels of measurement of dry-bulb and wet-bulb temperature (14.4, 15.15, 16.15, 17.4, 18.4, and 19.8 m). The array was mounted on a 21.3 m television tower. The system was thoroughly tested in the summer of 1974 as part of an energy balance study. The system proved to be very satisfactory. The very small temperature and vapor pressure gradients characteristically found over forests were successfully resolved. (Roberts-ISWS)
 W77-06653

LABORATORY STUDY OF THE FLEXURAL STRENGTH AND ELASTIC MODULUS OF FRESHWATER AND SALINE ICE,
 Iowa Univ., Iowa City. Inst. of Hydraulic Research.
 For primary bibliographic entry see Field 2C.
 W77-06661

COMPUTER MAPPING OF LANDSAT DATA FOR ENVIRONMENTAL APPLICATIONS,
 Bendix Aerospace Systems Div. Ann Arbor, Mich.
 For primary bibliographic entry see Field 5A.
 W77-06666

A STUDY OF THE UTILIZATION OF EREP DATA FROM THE WABASH RIVER BASIN,
 Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
 L. F. Silva.

Available from the National Technical Information Service, Springfield, VA 22161 as N76-19508. Price codes: A08 in paper copy, A01 in microfiche. Final Report, Project SR397, 1976. 143 p, 48 fig, 53 tab, 28 ref, 1 append. NASA NAS9-13301, NASA NGL15-005-112.

Descriptors: *Remote sensing, *Satellites (Artificial), *Instrumentation, *Indiana, Vegetation, Crops, Forests, *Land use, Water resources, Cities, Urbanization, Atmosphere, Classification, Soil classification, Analytical techniques, Radiation, Photography.
 Identifiers: *Skylab, *LANDSAT, *Wabash River Basin (Ind).

Data from the Earth Resource Experiment Package (EREP) on Skylab were used to study the utilization of these data in the Wabash River Basin. The study of the spacecraft multispectral data sets indicated that better land use delineation using machine processing techniques can be obtained with data from multispectral scanners than digitized S190A photographic sensor data. Better results were obtained for both a late spring scene and, to a much more significant degree, a winter scene. Comparable results were obtained from the LANDSAT 1 and Skylab S192 scanners for the late spring scene even though the S192 scanner contained channels with a broader spectral range and smaller spectral resolutions. The results of the multi-emulsion photographic data set were a little better than the multiband photographic data set. The results of the comparison of the interim and

filtered S192 data indicated that the data were improved some for machine processing techniques. It is questionable, however, whether the improvement obtained was worth the time and resources spent in the filtering effort. The results of the S192 X-5 detector array studies over a wintertime scene indicated that a good quality far infrared channel can be very useful. The results of the S191 spectroradiometer study indicated that the data from the S191 was usable, and it was possible to estimate the path radiance. The results of the channel significance study indicated that channel 11, a middle infrared band, was very useful in all three data sets. Based on these studies, it was recommended that future space earth resource systems include multispectral scanners which contain channels in the middle infrared and the far infrared in addition to channels in the visible and near infrared. (Sims-ISWS)
 W77-06670

ELECTRICALLY POWERED SAMPLER FOR BENTHIC MACROINVERTEBRATES,
 Stephen F. Austin State Univ., Nacogdoches, Tex. Dept. of Biology.
 J. D. McCullough, and S. Williams.
 The Progressive Fish-Culturist, Vol 38, No 4, p 186-187, 1976. 2 fig.

Descriptors: *Equipment, *Sampling, *Bottom sampling, Bottom sediments, Electric motor, Research equipment, On-site tests, *Benthos, Methodology, On-site investigations, Invertebrates.
 Identifiers: Grab samplers.

A 6.8 kg benthic sampler has been developed which uses an electric motor to close the jaws with enough force (408.2 kg) to break small branches and roots and to penetrate even hard clay to a depth of 8 cm. (Katz)
 W77-06757

INVESTIGATION OF PRECIPITATION WITHIN FOREST ECOSYSTEMS, (IN HUNGARIAN),
 Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Botany.
 For primary bibliographic entry see Field 2B.
 W77-06797

A SINGLE FIELD OF VIEW METHOD FOR RETRIEVING TROPOSPHERIC TEMPERATURE PROFILES FROM CLOUD-CONTAMINATED RADIANCE DATA,
 Texas A and M Univ., College Station. Center for Applied Geosciences.
 For primary bibliographic entry see Field 2B.
 W77-06887

USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEATIONS; DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE,
 Cold Regions Research and Engineering Lab. Hanover, N.H. Research Div.
 For primary bibliographic entry see Field 8D.
 W77-06888

A DEVICE FOR MEASURING SEEPAGE FLUX IN LAKES AND ESTUARIES,
 Waterloo Univ. (Ontario). Dept. of Earth Sciences.
 D. R. Lee.
 Limnology and Oceanography, Vol 22, No 1, p 140-147, January 1977. 8 fig, 2 tab, 14 ref.

Descriptors: *Seepage, *Estuaries, *Instrumentation, *Wisconsin, *Minnesota, *North Carolina, Lakes, Laboratory tests, Groundwater, Permeability, Water, Wells, Observation wells, Benthic fauna, Plastics.

Identifiers: *Seepage flux, *Hydraulic head, *Nova Scotia, Seepage inflow, Seepage velocity, Seepage cylinder.

Seepage flux can be measured and samples of groundwater flowing into lakes and estuaries can be collected by enclosing an area of bottom with a cylinder vented to a plastic bag. The method has the advantage of not requiring measurements of permeability of bottom sediments. Seepage velocities from -0.1-2.58 micrometer/s were measured in Minnesota and Wisconsin lakes and in Nova Scotia and North Carolina estuaries. Where seepage inflow was rapid (0.4-0.8 micrometer/s), water collected with the seepage meter was chemically similar to water from wells on the same flow path, and the distribution and chemistry of the seepage concurred with the theoretical flow net. The rate and direction of seepage flux were correlated with water surface elevation during a tidal cycle. (Roberts-ISWS)
 W77-06903

NASA DEVELOPS WATER MONITORING SYSTEM,
 Boeing Aerospace Co., Seattle, Wash.
 For primary bibliographic entry see Field 5A.
 W77-06912

RIVER BASIN SNOW MAPPING AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE,
 National Environmental Satellite Service, Washington, D.C.
 For primary bibliographic entry see Field 2C.
 W77-06915

OPTIC DEVICE FOR OBSERVATIONS OF SMALL ORGANISMS UNDER WATER, (IN RUSSIAN),
 Ukrainskii Nauchno-Issledovatel'skii Institut Ekspertimentalnoi Veterinari, Kharkov (USSR). Veterinary Research Station.
 L. K. Likhovoz.
 Parazitologiya (Leningr) 9(5), p 461-462, 1975.

Descriptors: *Instrumentation, *On-site investigations, *Aquatic animals, Bodies of water, Hatching, Aquatic insects, Underwater.
 Identifiers: *Optic device, Observations.

Dismountable magnifying optic device was designed and tested in order to raise the labor productivity, safety and quality of investigations in water bodies, hatching sites of black fly larvae, mosquitoes and other small hydrobionts.—Copyright 1976, Biological Abstracts, Inc.
 W77-06926

A UNIVERSAL CALIBRATION EQUATION FOR PRICE METERS AND SIMILAR INSTRUMENTS,
 Canada Centre for Inland Waters, Burlington (Ontario).
 P. Engel.
 Scientific Series No. 65, 1976, 12 p., 12 fig., 2 tab, 7 ref.

Descriptors: *Measurement, *Instrumentation, *Equations, Costs, Velocity, Fluid properties, Saline water, Freshwater, Streamflow, *Calibration.
 Identifiers: *Price current meters, Fluid density, Calibration accuracy.

A universal calibration curve has been developed using theoretical and empirical methods. The analysis shows that for a meter of given rotor diameter and fixed frictional resistance, the rate of rotation of the meter rotor is dependent only on the speed of the fluid and the fluid density. Changes in temperature and small changes in density as experienced when changing from fresh water to salt water do not have a significant effect on measure-

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

ment accuracy. A practical form of the calibration equation is given. Suggestions are made for applying the universal calibration equation to calibrations of current meters in wind tunnels. The principles developed can be applied to other current meters used in oceanographic and lake surveys as well as anemometers used to measure wind velocities. (WATDOC)
W77-06943

MEASUREMENT IN A MARINE ENVIRONMENT USING LOW COST SENSORS OF TEMPERATURE AND DISSOLVED OXYGEN,
National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service; and Geological Survey, Edgewater, Md. Water Resources Div.
F. A. Godshall, R. L. Cory, and D. E. Phinney.
Chesapeake Science, Vol 15, No 3, p 178-181, September 1974. 5 fig, 5 ref.

Descriptors: *Dissolved oxygen, *Water temperature, *Chesapeake Bay, *Estuaries, *Analytical techniques, Sampling, On-site data collections, Costs, Research equipment, Evaluation, *Maryland, *Measurement, Instrumentation.
Identifiers: *Chemical thermometers, Rhode River(Md).

Continuous records of physical parameters of the marine environment are difficult as well as expensive to obtain. This paper describes preliminary results of an investigative program with the purpose of developing low cost time integrating measurement and averaging devices for water temperature and dissolved oxygen. Measurements were made in an estuarine area of the Chesapeake Bay over two week periods. With chemical thermometers average water temperature for the two week period was found to be equal to average water temperature measured with thermocouples plus or minus 1.0 C. The slow diffusion of oxygen through the semipermeable sides of plastic bottles permitted the use of water filled bottles to obtain averaged oxygen measurements. Oxygen measurements for two week averaging times using 500 ml polyethylene bottles were found to vary from conventionally measured and averaged dissolved oxygen by about 1.8 mg/liter. (Woodard-USGS)
W77-06960

HYDROLOGIC INTERPRETATION OF GEOPHYSICAL DATA FROM THE SOUTHEASTERN HUECO BOLSON, EL PASO AND HUDSPETH COUNTIES, TEXAS,
Geological Survey, El Paso, Tex. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-06970

IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS USING LANDSAT-1 (ERTS-1) IMAGERY,
Geological Survey, Nashville, Tenn. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-06972

7C. Evaluation, Processing and Publication

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMATILLA DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT

WITH IRRIGABLE AREA, GRANDE RONDE DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06603

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, POWDER DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06604

OREGON'S LONG RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR RIVER DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06605

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, OWYHEE DRAINAGE BASIN,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-06606

SIMPLE FORMULAE FOR THE ESTIMATION OF WET BULB TEMPERATURE AND PRECIPITABLE WATER,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2B.
W77-06646

AREA-DEPTH RELATIONS FOR FREQUENCY VALUES OF RAINFALL,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2B.
W77-06647

EXCHANGE THROUGH A BARRIER ISLAND INLET: ADDITIONAL EVIDENCE OF UPWELLING OFF THE NORTHEAST COAST OF NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Geosciences; and North Carolina State Univ., Raleigh. Center for Marine and Coastal Studies.
For primary bibliographic entry see Field 2L.
W77-06654

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY,
Bendix Aerospace Systems Div. Ann Arbor, Mich.
For primary bibliographic entry see Field 5A.
W77-06665

COMPUTER MAPPING OF LANDSAT DATA FOR ENVIRONMENTAL APPLICATIONS,
Bendix Aerospace Systems Div. Ann Arbor, Mich.
For primary bibliographic entry see Field 5A.
W77-06666

COMPUTING EOLIAN SAND TRANSPORT FROM ROUTINE WEATHER DATA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.; and Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
For primary bibliographic entry see Field 2L.
W77-06669

A STUDY OF THE UTILIZATION OF EREP DATA FROM THE WABASH RIVER BASIN,
Purdue Univ., Lafayette, Ind. Lab for Applications of Remote Sensing.
For primary bibliographic entry see Field 7B.
W77-06670

CONSTRUCTION AND ADJUSTMENT OF A TWO-LAYER MATHEMATICAL MODEL OF THE LLOBREGAT DELTA,
Ministerio de Obras Publicas, Barcelona (Spain). Computer Centre.
For primary bibliographic entry see Field 4A.
W77-06722

HYBRID COMPUTER ANALYSIS OF A COMBINED SURFACE WATER-GROUNDWATER SYSTEM,
City Univ., London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-06729

FURTHER DEVELOPMENT AND TESTING OF A STREAM-AQUIFER SYSTEM MODEL,
Kansas Water Resources Research Inst., Lawrence.
For primary bibliographic entry see Field 2F.
W77-06762

AN AERIAL CENSUS OF SPOTTED SEALS, PHOCA VITULINA LARGHA,
Alaska Dept. of Fish and Game, Fairbanks.
For primary bibliographic entry see Field 6G.
W77-06800

SMOOTHING DATA WITH CUBIC SPLINES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
B. A. Kimball.
Agron J., (68) p 126-129. 1976.

Descriptors: *Statistical methods, *Statistics, *Soil moisture, *Mathematical studies, Sampling, Equations, Moisture content, Data collections, Agronomy, *Data processing.
Identifiers: *Cubic splines, *Mathematical smoothing.

Agronomic data frequently requires smoothing in order to obtain a reliable functional relationship for interpolating, predicting or determining the rate of change of one variable with respect to another. To test whether cubic spline functions could provide satisfactory smoothing, the necessary equations were derived, computer programs written, and several sets of soil temperature and water content data were smoothed. Cubic spline smoothing displayed the following advantages: Because spline functions are defined piecewise, they can represent any variable arbitrarily well over wide ranges of the other. The data can be obtained at unequal intervals, so high sampling rates can be used where changes are rapid and low rates where they are slow. Additionally, the gradients derived from cubic spline functions are smoothly joined parabolas, not the abruptly joined straightline segments characteristic of parabolic spline smoothing. --Copyright 1976, Biological Abstracts, Inc.
W77-06831

A COMPREHENSIVE PLAN FOR THE GLOBAL INVESTIGATION OF POLLUTION IN THE MARINE ENVIRONMENT AND BASELINE STUDY GUIDELINES.
United Nations Educational Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 5A.
W77-06850

LAKE ONTARIO ATLAS: SURFACE WAVES,
New York Sea Grant Inst., Albany.
For primary bibliographic entry see Field 2H.
W77-06884

RIVER BASIN SNOW MAPPING AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE,
National Environmental Satellite Service,
Washington, D.C.
For primary bibliographic entry see Field 2C.
W77-06915

DISSOLVED NITROGEN, DISSOLVED OXYGEN AND RELATED WATER TEMPERATURES IN THE COLUMBIA AND LOWER SNAKE RIVERS, 1965-1969,
National Marine Fisheries Service, Seattle, Wash.
For primary bibliographic entry see Field 5C.
W77-06925

TABLES AND TYPE CURVES FOR ANALYSIS OF PUMP TESTS IN LEAKY PARALLEL-CHANNEL AQUIFERS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 4B.
W77-06941

FLOOD HAZARD INFORMATION: CAVE CREEK, ARIZONA CANAL TO 19TH AVENUE, PHOENIX, ARIZONA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W77-06954

NUMERICAL MODELS OF WIND-DRIVEN CIRCULATION IN LAKES,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 2H.
W77-06958

RECONNAISSANCE OF THE WATER RESOURCES OF THE CLINTON QUADRANGLE, WEST-CENTRAL OKLAHOMA,
Geological Survey, Oklahoma City, Okla. Water Resources Div.
J. E. Carr, and D. L. Bergman.
Oklahoma Geological Survey, Norman, Hydrologic Atlas 5, 1976. 4 sheets, 14 fig, 3 tab, 11 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater resources, *Water quality, *Oklahoma, Available water, Streams, Maps, Water utilization, Irrigation, Industries, Domestic water, Hydrogeology, Aquifer characteristics, Withdrawal, Groundwater recharge, Chemical analysis, Water supply.
Identifiers: *Clinton quadrangle (Okla).

This 4-sheet atlas describes surface and ground-water conditions in the Clinton quadrangle which encompasses the red-bed plains of west-central Oklahoma. The mean annual precipitation ranges from about 22 inches in the west to about 30 inches in the east. High mineralization makes water from most streams in the quadrangle unsuitable for municipal use during low-flow periods. Gypsum and halite from natural sources are the principal causes of mineralization. The amount of water used during 1971 for municipal, industrial, rural-domestic, and irrigation purposes is estimated at 36 billion gallons. Irrigation accounted for 33.2 billion gallons; municipal and industrial demand accounted for 1.8 billion gallons; and rural-domestic use accounted for about 1.0 billion gallons. Ground water is the major source of water used in the quadrangle. Ground-water withdrawal for irrigation amounted to 28.9 billion gallons, or 87 percent of the total irrigation water used. More than 75 percent, 1.4 billion gallons, of the water used for mu-

nicipal and industrial purposes was taken from ground-water sources. Rural-domestic use accounted for withdrawal of an additional 1.0 billion gallons of ground water. (Woodard-USGS)
W77-06959

URBANIZATION AND FLOODING IN SHADES CREEK BASIN, JEFFERSON COUNTY, ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
For primary bibliographic entry see Field 4C.
W77-06977

FLOODS IN LOUISIANA, MAGNITUDE AND FREQUENCY, THIRD EDITION,
Geological Survey, Baton Rouge, La. Water Resources Div.
For primary bibliographic entry see Field 2E.
W77-06979

ON-LINE ADAPTIVE CONTROL FOR COMBINED SEWER SYSTEMS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5D.
W77-07100

8. ENGINEERING WORKS

8A. Structures

COST COMPARISON BETWEEN SUBTERRANE AND CURRENT TUNNELING METHODS,
Mathews (A. A.), Inc., Rockville, Md.
J. D. Bledsoe, J. E. Hill, and R. F. Coon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 481, Price codes: A05 in paper copy, A01 in microfiche. Report NSF-RA-T-75-001, May 1975. 96 p, 6 fig, 21 tab, 23 ref. NSF-C840.

Descriptors: *Tunneling, *Tunneling machines, *Cost analysis, *California, *Cost comparisons, Tunnel construction, Drilling, Tunnel linings, Underground structures, Excavation, Rock excavation, Costs, Construction, Construction costs, Construction equipment, Civil engineering.
Identifiers: *Thermal tunneling, Subterranean.

A study was made to compare tunnel construction costs between the Subterranean tunneling system and methods currently in use. Three completed tunnels were selected for study cases to represent finished diameters ranging from 3.05 m (10 ft) to 6.25 m (20.5 ft). The study cases were normalized by deleting extraneous work and assigning labor, equipment, and materials costs for the Southern California area in 1974. Detailed cost estimates (shown in Appendix A) were then made for the three tunnels for baselines. A conceptual nuclear powered Subterranean tunneling machine (NSTM) was designed. It was assumed that NSTM's were available for each of the three baseline tunnels. Costs were estimated (shown in Appendix B) for the baseline tunnels driven by NSTM. Savings of 12% for the 4.73 m (15.5 ft) tunnel and 6% for the 6.25 m (20.5 ft) tunnel were found to be possible using the NSTM as compared to current methods. A penalty of 30% was found for the 3.05 m (10 ft) tunnel using the NSTM. The cost advantage for the NSTM results from the combination of (1) a capital rather than labor intensive system, and (2) formation of both initial support and final lining in conjunction with the excavation process. (See W77-06663 and W77-06664) (Sims-ISWS)
W77-06662

COST COMPARISON BETWEEN SUBTERRANE AND CURRENT TUNNELING

METHODS, APPENDIX A—BASELINE COST ANALYSES,
Mathews (A. A.), Inc., Rockville, Md.
J. D. Bledsoe, J. E. Hill, and R. F. Coon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 482, Price codes: A15 in paper copy, A01 in microfiche. Report NSF-RA-T-75-001A, May 1975. 327 p. NSF-C840.

Descriptors: *Tunneling, *Tunneling machines, *Cost analysis, *California, *Cost comparisons, Tunnel construction, Drilling, Tunnel linings, Underground structures, Excavation, Rock excavation, Costs, Construction, Construction costs, Construction equipment, Civil engineering.
Identifiers: *Thermal tunneling, Subterranean.

A study was made to compare tunnel construction costs between the Subterranean tunneling system and methods currently in use. Three completed tunnels were selected for study cases to represent finished diameters ranging from 3.05 m (10 ft) to 6.25 m (20.5 ft). The study cases were normalized by deleting extraneous work and assigning labor, equipment, and materials costs for the Southern California area in 1974. Detailed cost estimates (shown in Appendix A) were then made for the three tunnels for baselines. A conceptual nuclear powered Subterranean tunneling machine (NSTM) was designed. It was assumed that NSTM's were available for each of the three baseline tunnels. Costs were estimated (shown in Appendix B) for the baseline tunnels driven by NSTM. Savings of 12% for the 4.73 m (15.5 ft) tunnel and 6% for the 6.25 m (20.5 ft) tunnel were found to be possible using the NSTM as compared to current methods. A penalty of 30% was found for the 3.05 m (10 ft) tunnel using the NSTM. The cost advantage for the NSTM results from the combination of (1) a capital rather than labor intensive system, and (2) formation of both initial support and final lining in conjunction with the excavation process. (See also W77-06662) (Sims-ISWS)
W77-06663

COST COMPARISON BETWEEN SUBTERRANE AND CURRENT TUNNELING METHODS, APPENDIX B—SUBTERRANE COST ANALYSES,
Mathews (A. A.), Inc., Rockville, Md.
J. D. Bledsoe, J. E. Hill, and R. F. Coon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 483, Price codes: A11 in paper copy, A01 in microfiche. Report NSF-RA-T-75-001B, May 1975. 233 p. NSF-C840.

Descriptors: *Tunneling, *Tunneling machines, *Cost analysis, *California, *Cost comparisons, Tunnel construction, Drilling, Tunnel linings, Underground structures, Excavation, Rock excavation, Costs, Construction, Construction costs, Construction equipment, Civil engineering.
Identifiers: *Thermal tunneling, Subterranean.

A study was made to compare tunnel construction costs between the Subterranean tunneling system and methods currently in use. Three completed tunnels were selected for study cases to represent finished diameters ranging from 3.05 m (10 ft) to 6.25 m (20.5 ft). The study cases were normalized by deleting extraneous work and assigning labor, equipment, and materials costs for the Southern California area in 1974. Detailed cost estimates (shown in Appendix A) were then made for the three tunnels for baselines. A conceptual nuclear powered Subterranean tunneling machine (NSTM) was designed. It was assumed that NSTM's were available for each of the three baseline tunnels. Costs were estimated (shown in Appendix B) for the baseline tunnels driven by NSTM. Savings of 12% for the 4.73 m (15.5 ft) tunnel and 6% for the 6.25 m (20.5 ft) tunnel were found to be possible using the NSTM as compared to current methods. A penalty of 30% was found for the 3.05 m (10 ft) tunnel using the NSTM. The cost advantage for

Field 8—ENGINEERING WORKS

Group 8A—Structures

the NSTM results from the combination of (1) a capital rather than labor intensive system, and (2) formation of both initial support and final lining in conjunction with the excavation process. (See also W77-06662) (Sims-ISWS)
W77-06664

NEW DESIGN GIVES DENVER DISTRICT IRON-FREE WELL.
Wright Water Engineers, Inc., Denver, Colo.
T. L. Decker, and R. E. Darr.
The Johnson Drillers Journal, Vol 49, No 1, p 5-8, January-February, 1977, 5 fig.

Descriptors: *Water wells, *Corrosion, *Iron bacteria, Construction materials, Stainless steel, Well casings, Logging(Recording), Well screens, Drilling, Aquifers, *Colorado.
Identifiers: *Fiberglass well casing, Non-corrosive materials, Denver Basin, Gravel packs, Shaw Heights Water District, *Denver(Colorado).

The Shaw Heights Water District in Colorado recently constructed a replacement well with both casing and well screen made entirely of corrosion-resistant materials. Out of eight deep wells purchased by the district in 1968 only one remained operational by 1975. The other seven wells were dropped out of service from time to time as yields of water quality deteriorated. The primary problem was the increasing iron content of the water. Although iron bacteria had not been specifically identified, their presence was suspected. Evidence pointed to a pickup of iron from the steel casing and slotted pipe as the cause of the increased iron content. Increased corrosion rates appeared to result from bacterial activity and alternating reducing-oxidizing conditions caused by pumping schedules. Iron bacteria probably were inadvertently introduced into the wells when installing test pumps or changing pumping equipment that was contaminated at another location. The replacement well was a gravel pack design utilizing 150 feet of 8 inch stainless steel screen. The well was completed to a depth of 664 feet. Seven inch fiberglass casing in 30 foot joints, with 0.5 inch thickness were installed. Rates as high as 80 gpm were used to develop the well during 5 1/2 days of pumping over 250,000 gallons of water. Just prior to termination of the pumping test a water sample contained total dissolved solids of 445 ppm. The iron content was 0.05 ppm, well below that of other local wells in the same aquifer. (Heiss-NWWA)
W77-06868

CONFERENCE ON RESEARCH IN TUNNELING AND EXCAVATION TECHNOLOGY.
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
For primary bibliographic entry see Field 8E.
W77-06885

8B. Hydraulics

A STUDY TO FORECAST THE WAVES AT DIGHA.
River Research Inst., Calcutta (India).
For primary bibliographic entry see Field 2L.
W77-06648

OPTIMIZATION MODEL OF A SYSTEM OF TWO OPEN-CHANNEL HYDROPLANTS.
Gdansk Technical Univ. (Poland). Inst. of Hydraulic Engineering.
For primary bibliographic entry see Field 4A.
W77-06716

PUMPING SYSTEMS: THE SIMPLER, THE BETTER.
Plummer and McDannald Drilling Co. Galena, Ohio.
For primary bibliographic entry see Field 8C.

W77-06856

THE LEGAL RESPONSIBILITY OF WATER WELL DRILLERS.
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 5G.
W77-06862

HYDRAULICS AND ECONOMICS OF WELL FIELD LAYOUT.
Universal Oil Products, St. Paul, Minn. Johnson Div.
Public Works, Vol 108, No 1, p 40-41, January, 1977, 3 fig, 3 ref.

Descriptors: *Pumping, *Drawdown, Hydraulics, Aquifers, *Economic efficiency, Water wells, Economics, Costs.
Identifiers: *Water well field, *Multiple wells, Well yield, Well diameter, Well interference.

Although decisions based on economics alone will frequently favor the drilling of a single well of large yield as opposed to multiple wells of limited yield, the principle of hydraulics often suggest the opposite conclusion. In an extensive aquifer, a ring of wells equidistantly spaced has nearly the same performance effects as one very large well at the center of the ring. For example, one analysis of a ring of eight 12-inch wells on a circle of 1,000 feet diameter showed the theoretical performance of a single well 550 feet in diameter discharging at a rate equal to the composite yield of the smaller wells. In general, a multiple well system is more favorable in thin aquifers and in finer sand formations, or situations where transmissivity varies with both thickness and permeability of the sand formation. In water-bearing formations of considerable thickness (50 feet or more) a single high capacity well may be preferred. (Eberle-NWWA)
W77-06863

BITS AND PIECES.
Plummer and McDannald Co., Galena, Ohio.
For primary bibliographic entry see Field 8G.
W77-06866

SUBMERSIBLE PUMP DESIGN: DEPENDENT ON WELL DIAMETER AND DEPTH.
For primary bibliographic entry see Field 8C.
W77-06867

A LABORATORY STUDY OF FLUID AND SOIL MECHANICS PROCESSES DURING HYDRAULIC DREDGING (HYDRAULISCHE UND BODENTECHNISCHE VORGÄNGE BEIM GRUNDSÄUGEN).
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W77-06883

HYDRAULICS OF SHEET FLOW IN WETLANDS.
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Christensen.
Reprinted from: Proceedings of ASCE Symposium on Inland Waters for Navigation, Flood Control and Water Diversions held at Colorado State University, Aug 10-12, 1976. p 746-759, 4 fig, 10 ref.

Descriptors: Hydraulics, *Wetlands, *Sheet flow, *Forecasting, *Flood plains, Mannings equation, Vegetation, Equations, Overland flow.
Identifiers: Hydrodynamic drag.

The numerical prediction of sheet flow behavior in wetlands and flood plains is usually handled by use of the Manning equation. However, a successful

use of that formula requires a reasonably accurate estimate of Manning's n for such usually heavily vegetated areas. This is, in most cases, an impossible, or nearly impossible task which adds a substantial amount of uncertainties to this approach. Observations also tend to indicate that Manning's n should be a function not only of the type and degree of vegetation but also of the flow depth indicating that another power formula or a modified form of the Manning formula might be better than the classic Manning formula for describing this type of flow. Such an expression is developed in the present paper by considering the velocity distribution in overland flow in the turbulent rough flow range, i.e., for wall Reynolds' numbers in excess of seventy, and considering the equilibrium of forces in the direction of the flow taking the hydrodynamic drag on the vegetation into consideration. (NOAA)
W77-06929

8C. Hydraulic Machinery

IT'S ALL ON THE NAMEPLATE: EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT JET PUMPS.
Smith (A. O.), Tipp City, Ohio. Electric Motor Div.
M. F. Wendelin.
Water Well Journal, Vol. 31, No. 3, p 56-58, March, 1977, 1 fig, 3 tab.

Descriptors: *Pumps, *Electric motors, Water wells.
Identifiers: *Jet pumps, Motor nameplates.

Pump nameplates furnish the dealer or installer with vital information concerning the operation of the unit. Usually included are data such as diagrams for hook-up to proper voltage, whether or not there is a thermal cutoff device, Canadian Standards Association insignia if unit is approved for installation in Canada, model and serial numbers, nominal HP of motor, amps, single or three-phase designation, RPMs, motor frame size, service factor (indicates permissible horsepower loading), class of insulation and maximum ambient temperature, electrical type (relative to starting), locked rotor KVA per horsepower rating, and UL approval. (Eberle-NWWA)
W77-06854

PUMPING SYSTEMS: THE SIMPLER, THE BETTER.
Plummer and McDannald Drilling Co. Galena, Ohio.
R. B. McDannald.
Water Well Journal, Vol. 31, No. 3, p 30-31, March, 1977.

Descriptors: *Pumps, *Hydraulic systems, *Corrosion, *Electrical equipment, Performance, Capacitors, Electrical motors, Electric wires, Electrolysis, Water wells, Plastic pipes.
Identifiers: *Submersible pumps, Electrical connections, Pumping system design.

Simple water pumping systems are superior in maintenance, frequency and life of system. The basic components of pumping systems are: the pump motor, the motor electrical system, the pump components housings, impellers, shafts, bearings and pump casing. Applications usually dictate the type of pump used. Motor differences such as capacitor start-capacitor run of capacitor start-winding run types dictate the application. The materials used in the construction of pump components are critical due to the corrosive environmental in which the pump may operate. Stainless steel, brass or plastic seem to resist corrosion better than other materials. The connection between the pump and the drop pipe is vulnerable to corrosion if two different types of metal are used together, for example galvanized steel connected to brass. PVC nipple spacers should be

used as connections to preclude connection corrosion. All PVC drop pipe may be used in these cases also. Wiring connections should be made with properly applied electrical tape. Wiring should be of sufficient length to accommodate 'growth' or stretch of the drop pipe after installation.
W77-06856

ONE GOOD IDEA SPURS ANOTHER.

Ground Water Age, Vol 11, No 5, p 21-22, January, 1977. 1 fig.

Descriptors: *Drilling equipment, Well drilling, *Rotary drilling, Water wells.
Identifiers: *Drilling pipe clamps, Time saving innovations, Equipment installation tools.

Two innovative rotary drilling devices designed specifically to speed up well drilling operations were invented and introduced by the Eastwood Drilling company. The pipe holder, mounted on the drilling rig, consists of four 'Slips' of case hardened, high tensile steel, with multiple sharpened horizontal grooves. The holder locks a length of pipe in place with a handle. The pipe lifter operates on the same principle except in an 'internal way'. Swung from the boom, the lifter inserts into a length of pipe and locks with a thumb catch. From the rack of casings, the boom operator can swing a length over the one held by the holder, enabling the two sections to be welded together. The Eastwoods' devices are able to handle all sizes of pipe from six to twelve inch diameters. (Heiss-NWNA)
W77-06860

SUBMERSIBLE PUMP DESIGN: DEPENDENT ON WELL DIAMETER AND DEPTH.

Water Well Journal, Vol 31, No 3, p 51-54, March, 1977. 1 tab.

Descriptors: *Pumps, *Deep wells, Water levels, Impellers, Water wells.
Identifiers: *Submersible pumps, *Well design, Well diameter, Vertical turbine pumps, Net required inlet head, Total available inlet head.

Recent improvements in submersible electric motors, watertight seals, and power cables have resulted in the submersible pump, which eliminates the long drive shafts and bearing assemblies necessary for the surface-driven vertical turbine pumps originally developed for deep wells. Proper well design, however, is essential for obtaining good performances and long life of the submersible pump. Well diameter is directly related to the size of the pump; a good rule is to select a well casing two sizes larger than the nominal pump diameter. Submersible pumps lift water by developing a negative pressure head, allowing atmospheric pressure to raise water to the surface. A certain amount of hydraulic head at the pump inlet is necessary to prevent pump damage to cavitation ('net required inlet head' or NRIH). For proper pump operation, the 'total available inlet head' must exceed the sum of the NRIH plus water vapor pressure plus entrance and friction losses. Total available inlet head can be increased by placing the pump inlet at a lower level of the well or by lowering pumping rate to decrease drawdown. (Eberle-NWNA)
W77-06867

HOW TO DEAL WITH PITTING AND CORROSION.

For primary bibliographic entry see Field 8G.
W77-06869

GUIDELINES FOR THE PREPARATION OF ENVIRONMENTAL REPORTS FOR FOSSIL-FUELED STEAM ELECTRIC GENERATING STATIONS.

United Engineers and Constructors, Inc., Philadelphia, Pa.
For primary bibliographic entry see Field 6G.

W77-06918

8D. Soil Mechanics

A LABORATORY STUDY OF FLUID AND SOIL MECHANICS PROCESSES DURING HYDRAULIC DREDGING (HYDRAULISCHE UND BODENTECHNISCHE VORGÄNGE BEIM GRUNDSAUGEN).
Texas A and M Univ., College Station. Dept. of Civil Engineering.
H. Salzmann.

Sea Grant Report No. TAMU-SG-77-204, February 1977. Translation from German by Gertrud M. Adams. Edited by David R. Basco. 178 p, 93 fig, 4 tab, 35 ref.

Descriptors: *Soil mechanics, *Soil types, Hydraulic equipment, Hydraulics, Resources development, Dredging.
Identifiers: Hydraulic dredging.

The objectives of this paper are: (1) to describe the processes between water (suction flow) and soil during hydraulic dredging; (2) to determine the influence of soil type; (3) to determine the influence of the shape of the suction head; and (4) to determine the influence of supplementary pressured water jets upon the output of solid material output into which all soil-mechanical, hydraulic, geometric and pumping conditions of hydraulic dredging are incorporated. (NOAA)
W77-06883

USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEATIONS: DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE.

Cold Regions Research and Engineering Lab. Hanover, N.H. Research Div.
H. L. McKim, and C. J. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-023 276. Price Codes: A03 in paper copy, A01 in microfiche. Special Report 242, Part I, December 1975. 26 p, 19 fig, 5 tab, 11 ref.

Descriptors: *Remote sensing, *Construction materials, *Dam construction, *Maine, Damsites, Earth dams, Dikes, Aerial photography, Satellites(Artificial), Aircraft, Geology, Earthquakes, Geological surveys, Geologic units, Geologic mapping, Geologic formations, Fractures(Geologic), Faults(Geologic), Projects, Reservoirs.
Identifiers: *Geologic lineations, *Dickey-Lincoln School Lake Project(ME).

A potential site for construction of a series of earth dams and dikes with a maximum height of 335 ft, the Dickey-Lincoln School Lakes Project, is being evaluated. The site is located on the St. John River in Aroostook County, Maine, approximately 30 mi west of the town of Ft. Kent. The project is primarily designed to generate hydroelectric power, but it is also intended to provide flood control. During November 1974, a study was initiated to apply state-of-the-art remote sensing techniques to the delineation and quantification of surficial geology units to locate construction material within the headwaters of the St. John River Basin. A photomosaic was prepared from 1966 black and white photography (scale 1:33,600). Fourteen surficial geology units were delineated in an 1100-sq mi area. The areal extent of each surficial geology unit within a 4-mi radius of the 3 dike sites and within a 6-mi radius of the main dam site was quantified using a planimetric color densitometer. The volume of construction material was computed based upon these areal determinations and estimated depths. Considerable time was saved using remote sensing techniques compared with conventional ground surveys. The volume estimates obtained from this investigation were compared with the estimates of required construction

material computed during the 1967 initial design phase. The comparison showed that the required construction material could be found within the prescribed area around the dam and dike sites. Because transportation of materials is a major cost in dam construction, the reduction in transportation distances determined from this study could result in considerable savings. (Sims-ISWS)
W77-06888

8E. Rock Mechanics and Geology

CONFERENCE ON RESEARCH IN TUNNELING AND EXCAVATION TECHNOLOGY.

Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-246 680. Price codes: A05 in paper copy, A01 in microfiche. Report NSF-RA-T-73-097, Proceedings of a Conference held September 14-15, 1973, Spring Hill Conference Center, Wayzata, Minnesota, September 1973. 87 p. S.L. Crouch, Conference Chairman. NSF G1-40254.

Descriptors: *Rock mechanics, *Tunneling, *Conferences, *Excavation, Tunnel construction, Rock properties, Earth handling equipment, Tunneling machines, Drilling, Rock excavation, Rocks, Underground structures, Civil engineering.
Identifiers: *Tunnel boring.

The purposes of the conference were (1) to discuss the aims and progress of the NSF/RANN Excavation Technology Program, and (2) to give researchers an opportunity to present their recent findings and discuss them with others working in the field. Twenty different NSF/RANN-supported research projects were described during 7 conference sessions. Slightly more than half of the projects involved new or improved methods of excavating rock, while the rest were concerned with such aspects of excavation as: rock properties and their effects on tunnel boring, machine feasibility and advance rates, and structural and systems analysis of the excavations and the excavation process. (Sims-ISWS).
W77-06885

CHICAGO DRIVES LARGE BORES TO CONTROL COMBINED SEWAGE FLOW.

Engineering News-Record, Vol. 198, No. 5, p 20, February, 1977. 1 fig.

Descriptors: *Combined sewers, *Runoff, *Overflow, *Water pollution sources, *Pollution abatement, Construction, Reservoirs, Waste treatment, Waste water treatment, Engineering structures, Underground storage, Rock excavation, Tunnel excavation, Costs, Illinois, New York.
Identifiers: *Chicago(III), Rochester(NY).

Chicago has begun work on a program to control storm and sanitary sewage runoff by utilizing underground storage caverns. With pilot bores for testing tunneling and sealing completed, work on the remaining hardrock tunnels has proceeded. The two systems will contain 125 miles when completed in 10 years. Combined sewer overflow has been an irritant, creating problems of waterway pollution and disease. Sewer overflow has accounted for nearly 45% of the metropolitan area water pollution. The tunnel and reservoir plan provides for three reservoirs (118,000 acre/foot of combined sewage) which will pump stored water to surface plants for off-peak treatment. Rochester, New York, and other cities are considering similar plans. Also included in the system are a \$365 million mainstream system under downtown Chicago, \$114 million pumping station and associated structures, and tunnels, shafts, and pumping works estimated at \$183 million. Machine mining without blasting is to be used for hardrock

Field 8—ENGINEERING WORKS

Group 8E—Rock Mechanics and Geology

tunneling to avoid surface disturbances. Shale portions of rock must be concrete-lined, and more competent rock must be 100% grouted to prevent infiltration. Surface disturbance must be minimized when drop shafts are excavated. (Collins-FIRL)
W77-06988

8F. Concrete

METHANE-DERIVED CARBONATE CEMENTS IN BARRIER AND BEACH SANDS OF A SUB-TROPICAL DELTA COMPLEX.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W77-06677

SLIPFORM PAVER, STEEL FORMS SPEED LINING OF 25,000-FOOT SEWER TUNNEL.
N. Hancock.
Engineering and Contract Record, Vol. 90, No. 1, p 64-65, January, 1977. 1 fig.

Descriptors: *Tunnel linings, *Tunnel construction, Sewers, Engineering structures, Construction, Concrete construction, Concrete placing, Equipment, Underground structures, Construction equipment, Canada.
Identifiers: Montreal(Canada).

A slipform paver was used to pour a 12-inch concrete lining for a 25,000-foot sewer tunnel in Montreal, Canada. Special steel forms were used for the 16-foot horseshoe-shaped arch and wall. The Miller M9000 paver can slipform up to 16 feet wide and 2 feet deep and was used to form curbs and an invert. After a very successful experience with tunnels for the Montreal subway system, modifications were instituted to make the apparatus applicable to sewer tunnel construction. Telescoping steel forms with hinged upper quarters were used on the horseshoe portion of the tunnel. When the first form is anchored and the concrete is poured, the second 40-foot form is moved ahead, anchored, and more concrete is poured. This operation is repeated until the first form is ready to be moved on the 20-foot traveler to a new position. This process completes about 1,000 feet of wall and arch per week. (Collins-FIRL)
W77-06992

WASTE WATER TREATMENT PLANT BUILT IN WET HOLE.
For primary bibliographic entry see Field 5D.
W77-07021

8G. Materials

IT'S ALL ON THE NAMEPLATE: EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT JET PUMPS.
Smith (A. O.), Tipp City, Ohio. Electric Motor Div.
For primary bibliographic entry see Field 8C.
W77-06854

MAKE WIRE ROPE LAST-TREAT IT LIKE A MACHINE.
The Drilling Contractor, Vol. 33, No. 1, p 55, January-February, 1977. 2 fig.

Descriptors: *Drilling equipment, Mechanical properties, Flexibility, Stress analysis, Strain measurement.
Identifiers: *Wire rope, Rope cores, Strand construction.

Wire rope is a piece of flexible, multi-wired stranded machinery made up of many precision

parts. The usual type of wire rope consists of a core member around which any number of multi-wired strands are "laid" or helically wrapped. Wire ropes are specifically tailored for special uses. These specific designs are accomplished by combinations of wire size, number and arrangements, and by length and direction of lay. Wire rope should be selected with the specific use in mind. Proper selection includes such factors as: the lay of the rope (right, left, regular or lang), type of strand construction, the proper combination of wire diameters, the proper combination of physical properties of the wires, i.e., tensile strength, elongation, resistance to torsion, hardness and fatigue resistance, the relative length of rope lay and of strand lay, and the specific size, type, grade and construction of the core. A great number of combinations are available in the fabrication of a wire rope. For best service from a wire rope it should be designed to meet the specific applications it will be used in. (Heiss-NWWA)
W77-06857

ONE GOOD IDEA SPURS ANOTHER.

For primary bibliographic entry see Field 8C.
W77-06860

ELECTRIC LOGGING.
National Water Well Association, Worthington, Ohio.
T. E. Gass.
Water Well Journal, Vol 31, No 3, p 34-35, March, 1977. 2 fig.

Descriptors: *Electrical well logging, Resistivity, Logging(Recording), Boreholes, Water wells.

Electric log interpretation is best left to experienced trained hydrologists, however, well drillers can make some basic readings if they know what to look for. E-log interpretation involves simultaneous reading of the spontaneous potential (SP) and resistivity curves, which relate to the fluids in the formation, and comparison with the drillers log, which indicates lithologic change. SP variations in unconsolidated material are read relative to a fairly uniform baseline obtained in clays. Shifts to the right generally indicate fresh water in permeable material. Shifts to the left show a higher concentration of dissolved solids, large shifts indicating saline water. For the resistivity curve, shifts to the right indicate fresh water or dense rock, movement to the left indicates clay or saline water. (Eberle-NWWA)
W77-06865

BITS AND PIECES.

Plummer and McDannald Co., Galena, Ohio.
R. B. McDannald.
Water Well Journal, Vol 31, No 2, p 21, February, 1977.

Descriptors: *Well casings, *Electronic equipment, Water wells.
Identifiers: *Pitless adapters, *Capped wells, Magnetic locators, Well depth measurement.

The problem of locating wells that have been cut off and capped below ground may diminish as legislation and modern well drilling and completion methods promote increased use of pitless adapters. For those cases in which a driller must locate a lost well, the Schonstedt Model GA-32 Magnetic Locator is recommended. This portable and easy-to-use tool enables one to detect cut-off casing at depths up to 5 1/2 feet, and is useful for finding curb boxes, valves, and septic tank lids. Also recommended is a measuring tool available from Velsen Pump and Supply (Norton, Ohio) used for measuring deep holes being drilled by cable-tool methods. (Eberle-NWWA)
W77-06866

NEW DESIGN GIVES DENVER DISTRICT IRON-FREE WELL.
Wright Water Engineers, Inc., Denver, Colo.
For primary bibliographic entry see Field 8A.
W77-06868

HOW TO DEAL WITH PITTING AND CORROSION.

Water Well Journal, Vol 31, No 3, p 48, March, 1977.

Descriptors: *Corrosion control, *Pitting(Corrosion), *Pumps, Jets, Bacteria algae, *Chlorination, Acidity, Neutralization, Water wells, Water quality control.
Identifiers: Soda ash solution.

Pitting due to organic growth and corrosion due to acid well water frequently shorten the life of pumps, drop pipes, jets, bowl assemblies, and cylinders. Pitting results when bacteria and algae attach themselves to metal surfaces, forming minute electrolytic cells and drawing metallic ions from the equipment surfaces into surrounding water. Inexpensive automatic chlorinators help control these organisms and thus prolong pump life. Acid ground waters which can cause rapid corrosion and deterioration of entire water systems can easily be detected with a simple pH tester. These acid waters may be neutralized by combining soda ash solution with chlorine solution and feeding the mixture into the well via automatic chlorination equipment. (Eberle-NWWA)
W77-06869

USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEATIONS: DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE.
Cold Regions Research and Engineering Lab. Hanover, N.H. Research Div.
For primary bibliographic entry see Field 8D.
W77-06888

SAND STABILIZATION ON THE DUNES, BEACH AND SHOREFACE OF A HISTORICALLY ERODING BARRIER ISLAND. WAS-SAW ISLAND EROSION STUDY, PART III.
Georgia Marine Science Center, Savannah.
George F. Oertel, and James L. Harding.
Georgia Marine Science Center Sea Grant Technical Report Series No 77-3, (1977). 47 p, 4 fig, 7 ref, 3 append. TRS-77-3. SG-04-5-158-4.

Descriptors: *Georgia, *Barrier islands, *Erosion control, *Sedimentation, *Stabilization, *Shore protection, Dunes, Beaches, Shores.
Identifiers: Snow fences, Artificial seaweed, Durabags, Sea Grant Program.

Two earlier reports on the sedimentary framework and water-flow characteristics adjacent to the north end of Wassaw Island, Georgia supplement this report. The effects of synthetic devices on the sediment budget of a historically eroding area of shore is described. Three devices were used to modify the sediment transport patterns in order to control erosion. The marginal tidal channel at the north end of Wassaw Island appears to be a critical feature controlling the development of the shore. Submarine pervious dikes such as those constructed with Durabags are useful structures for keeping the marginal channels open. When these channels are open, sediment is transported to and deposited at the north end of Wassaw Island. Snow fences appeared to be an effective means of trapping and storing large quantities of sand on the upper beach. However, fences were only effective where rapid beach growth produced broad areas of loose sand available for eolian transport. Snow fences were not an effective means of building the beach in areas where the beach is eroding and the shoreline is retreating. Small plots of artificial seagrass had no obvious contributing effect for producing a source of sediment for the beach. (Sinha-OEIS)

W77-06940

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1974-75.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W77-06948

TESTING AND GROUTING LEAKING JOINTS.
Halliburton Services, Duncan, Okla. Environmental Control Dept.
J. Herndon.
Water and Sewage Works, Vol. 124, No. 1, p 76, January, 1977. 1 fig.

Descriptors: *Grouting, *Chemical grouting, *Leakage, *Equipment, Sealants, Seepage, Sewerage, Infiltration, Testing, Repairing.

A three-element packer was designed to alleviate the problem of sewer infiltration through faulty joints. This instrument tests, grouts and retests joints. The packer contains a liquid-filled center portion connected to a direct reading, Bourdon tube pressure gauge which is viewed by television during air testing or grouting. The packer is usually pulled through the sewer line from the downstream manhole. The air test is performed by applying air to the center void until test pressure is attained; the pressure is released from the line and stays trapped in the void around the joint. Void pressure decrease indicates a leak. PWG chemical grout is mixed and pumped in two streams to the packer and, as the grout is injected, the two streams mix to begin a reaction which forms a high-strength gelled material that squeezes around the center element and fills the void between the flows into the leaking joint. This prevents further leakage. If necessary, retesting of the joint can be performed by deflating and reinflating the end elements of the packer. The system is efficient and can be controlled by one operator. It is also economical since a minimum amount of grout is wasted and no excess is used. (Collins-FIRL)
W77-06986

CINCINNATI'S PREVENTIVE MAINTENANCE SEWER PROGRAM.
For primary bibliographic entry see Field 5G.
W77-06989

PREVENTIVE SEWER MAINTENANCE HELPS PRESERVE HISTORIC ANNAPOLIS.
Public Works, Vol. 108, No. 2, p 58-59, February, 1977.

Descriptors: *Sewerage, *Inspection, *Cleaning, *Equipment, *Maintenance, Water districts, Machinery, Repairing, Sanitary engineering, Water quality control, *Maryland.
Identifiers: *Annapolis(Md).

The role of sewer maintenance in preserving Annapolis, Maryland, as a clean city and tourist attraction was reviewed. The program was designed to prevent blockages which could cause backups and flooding. An evaluation of equipment was conducted in 1972 and a Myers-Sherman Vactor 'Jet-Rodder' was selected to bring the city's equipment level to a state of adequacy. First used full time on emergency work, the apparatus now cleans the entire system on a regular basis. Trouble spots are serviced every six months and the rest of the system is inspected annually and cleaned every two years. The former average of 370 emergency calls per year has been cut by more than 60%. Since the new machinery has been in use, there has been no severe basement flooding problem or back-up problem. Claims for blocked line damage were reduced by 50%. Economic savings have been made in maintenance and labor costs, as well as costs associated with treatment

and removal of the sludge previously accumulated in the system. Lift station wet wells are now cleaned every four months and the machinery has been used to remove sand and gravel from filters. Valve boxes can now be cleared of clogging debris and other adapted uses include the removal of dead fish accumulations from the harbor. (Collins-FIRL)
W77-06990

COPPER SULFATE FIGHTS ROOT GROWTH IN SEWER SYSTEMS.
S. B. Twiner.
Water and Sewage Works, Vol. 124, No. 1, p 40-41, January, 1977. 1 fig.

Descriptors: *Root distribution, *Root systems, *Copper sulfate, *Sewerage, *Cleaning, Drainage, Storm drains, Combined sewers, Municipal wastes, Domestic wastes, Hydrogen ion concentration, Flow.

Copper sulfate has become an effective cure for the problem of sewer and storm drain blockage by root and fungus growth. Root growth in pipes produces a mechanical obstruction causing unsanitary conditions, and an odor problem from the decomposition of detained organic matter. This obstruction deteriorates mortar pipe, joints, manholes, pipes and substructures, treatment plant units and mechanisms; it reduces the capacity of pumps, force mains and gravity lines, and it can lead to stream pollution. Copper sulfate treatment produces an immediate abatement of these conditions, but an exact usage formula has not been deduced. The only guideline is that the amount of needed copper sulfate is in ratio to the total mass of roots present. The pH-alkalinity test can be used to determine the existence of a problem as well as the results of treatment. Sewer and lateral application is by sprinkling copper sulfate along the invert of the pipe. In homes and buildings, flushing the chemical through the toilet is the prescribed procedure. About two pounds is used for home treatment. It is safe to use around trees because it results in only local killing action on the root system. It is a stable, crystalline, easily handled, mildly acidic material. Use should be planned only at low flow periods to avoid excess dilution. (Collins-FIRL)
W77-06991

SLIPFORM PAVER, STEEL FORMS SPEED LINING OF 25,000-FOOT SEWER TUNNEL.
For primary bibliographic entry see Field 8F.
W77-06992

CONTROL SEWER CORROSION WITH H2O2.
Corpus Christi Public Utilities, Tex.
D. G. Matthews.
The American City and County, Vol. 92, No. 2, p 65, February, 1977.

Descriptors: *Sewers, *Corrosion, *Corrosion control, *Odor, *Hydrogen sulfide, Waste treatment, Waste water treatment, Liners, Chemical reactions, Economics, *Texas.
Identifiers: *Hydrogen peroxide, *Corpus Christi(TX).

In Corpus Christi, Texas, hydrogen peroxide was used to control odor and hydrogen sulfide-induced corrosion. The city tried, unsuccessfully, to eliminate the problem with the use of liners for its concrete sewers. No liner material proved satisfactory. Peroxide completely oxidizes hydrogen sulfide. Water and sulfur are formed in acid or neutral sewage; water and sulfates are formed in alkaline sewage. Although available in various concentrations, a 50% solution of hydrogen peroxide is the maximum concentration that can be used safely and housed easily in residential areas, although the 70% solution is the more economical. Other alternatives were suggested, but the peroxide proved efficient and more effective. (Collins-FIRL)

W77-06993

CONTRACT SERVICES STRETCH SEWER MAINTENANCE BUDGET.
Gladstone Public Utilities, Mo.
D. C. Anderson.
The American City and County, Vol. 92, No. 2, p 53, February, 1977.

Descriptors: *Sewerage, *Maintenance, *Cleaning, Costs, Cities, Equipment, Personnel, Flood protection, Leakage, Odor, Root systems, Water pollution sources, Pollution abatement, Missouri.
Identifiers: *Gladstone(MO), Contracted maintenance.

The city of Gladstone, Missouri, has contracted its sewer maintenance work. The annual fee of \$9,000 enables the city to avoid the purchase and maintenance of \$100,000 worth of equipment. Personnel costs are also eliminated, as are insurance, unemployment compensation, hiring or overhead charges, and salaries. Round-the-clock service is guaranteed and the service keeps lines free of roots, leaks, and other obstructions. Flooding, odor, and pollution have all been abated as a result of this contracted service. (Collins-FIRL)
W77-06994

NEW PROGRAMS IMPROVE SENSITIVE AREAS OF WATER AND SEWER SYSTEMS.
Waltham Public Works, Mass.
E. F. Delaney.

Descriptors: *Sewage, *Instrumentation, Measurement, Equipment, Cities, Water use, Storage, Pumping plants, Design criteria, Interceptor sewers, *Massachusetts.
Identifiers: *Waltham(MA).

Waltham, Massachusetts, has embarked on a program of water and sewer improvements. The old and inaccurate metering system was first to be renovated to improve efficiency in accounting for water use. Nine thousand self-generating remote readout meters have already been installed, producing a \$33,000 savings in one year, and accounting for 138 million 'lost' gallons of water. These meters, which will eventually total 12,000, eliminate the need for access to homes. The specifications required a self-generating remote meter with a simplified two-wire system; a bronze mancase; noncorrosive gears and measuring chamber; a rust bottom plate for severe winters; and a hermetically sealed, easily removable register. The water program also included new municipal storage and pumping facilities, new pumping station and interceptors, and a preventive maintenance program. (Collins-FIRL)
W77-06995

WASTE WATER TREATMENT PLANT BUILT IN WET HOLE.
For primary bibliographic entry see Field 5D.
W77-07021

THE FABRIC-LINED PURIFICATION BASIN.
For primary bibliographic entry see Field 5D.
W77-07035

WHAT'S NEW IN LANDFILL LINERS.
For primary bibliographic entry see Field 5G.
W77-07051

8H. Rapid Excavation

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS.
Mathews (A. A.), Inc., Rockville, Md.
For primary bibliographic entry see Field 8A.

Field 8—ENGINEERING WORKS

Group 8H—Rapid Excavation

W77-06662

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS, APPENDIX A--BASELINE COST ANALYSES,

Mathews (A. A.), Inc., Rockville, Md.

For primary bibliographic entry see Field 8A.

W77-06663

COST COMPARISON BETWEEN SUBTERRANEAN AND CURRENT TUNNELING METHODS, APPENDIX B--SUBTERRANEAN COST ANALYSES,

Mathews (A. A.), Inc., Rockville, Md.

For primary bibliographic entry see Field 8A.

W77-06664

COASTAL ZONE MANAGEMENT, ANNOTATED BIBLIOGRAPHY, National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.

For primary bibliographic entry see Field 02L.

W77-06937

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1974-75,

Environmental Protection Service, Ottawa (Ontario).

For primary bibliographic entry see Field 05D.

W77-06948

8I. Fisheries Engineering

EGG INCUBATION AND LARVAL REARING OF NAVAGA (ELEGINUS NAVAGA PALL.), POLAR COD (BOREOGADUS SAIDA LEPECHIN) AND ARCTIC FLOUNDER (LIOPSETTA GLACIALIS PALL.) IN THE LABORATORY,

All Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).

T. M. Aronovich, S. I. Doroshev, L. V.

Spectorova, and V. M. Makhotin.

Aquaculture, Vol 6, 1975, p 233-242, 3 tab, 7 fig, 8 ref.

Descriptors: *Laboratory tests, *Incubation, *Larval growth stage, Eggs, Hatching, Larvae, Feeding rates, Fish.

Identifiers: Navaga, Arctic flounder, Polar cod, First feeding.

The incubation period for polar cod eggs was 35 days, for arctic flounder 41-42 days, and for navaga 48 days. Emergent larvae averaged 5.54 mm (polar cod), 6.0 mm (Navaga and 5.56 mm (arctic flounder). The rate of yolk sac absorption was higher in starving larvae than in feeding ones. In polar cod and arctic flounder the yolk sac was fully utilized by 18-20 days after hatching and 22-24 days after hatching for navaga. Starvation beyond 8-10 days after hatching was critical for navaga, and 20 days for polar cod. Artemia nauplii of about 600 microm in length and natural plankton consisting of Paracalanus and Pseudocalanus nauplii are suggested as an initial food for navaga and polar cod at a density of one organism/ml. Feeding efficiency of larvae at the time when they first established feeding was low. Food digestion in older larvae proceeded faster than in the early stages of development. Chilton-ORNL)

W77-06792

EXPERIMENT WITH A MULTIPOINT SYSTEM FOR JUDGING CARP FATTENING PONDS, (IN RUSSIAN),

Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).

For primary bibliographic entry see Field 02H.

W77-06798

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

PRELIMINARY BIBLIOGRAPHY ON GROUNDWATER IN DEVELOPING COUNTRIES,

Association of Geoscientists for International Development, St. John's (Newfoundland).

For primary bibliographic entry see Field 02F.

W77-06852

SUBJECT INDEX

- 2
Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B
- ABALONE**
Long-Term Lead Accumulation in Abalone (*Haliotis* Spp.) Fed on Lead-Treated Brown Algae (*Egregia Laevigata*), W77-06776 5C
- ABSORPTION**
The Accumulation of Organic Mercury from Sea Water by the Plaice, *Pleuronectes platessa* L., W77-06607 5C
LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C
Toxicity of Fluoride to Brown Trout Fry (*Salmo trutta*), W77-06628 5C
The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C
Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C
Effects of Various Ecological Factors on Radiostromium Uptake in Two Euryhaline Teleosts: *Mugil Auratus* Risso and *Pleuronectes Platessal*, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostromium Chez Deux Teleosteens Euryhalins: *Mugil Auratus* Risso et *Pleuronectes Platessa* L.), W77-06777 5C
Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I
- ACETIC ACID**
Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A
- ACID SOLUBILIZATION**
Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E
- ACIDS**
Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A
Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E
- ACROLEIN**
The Influence of Acrolein and Hydrocrylic on the Development Dynamics of Aquatic Bacteria, W77-06690 5C
- ACTIVATED CARBON**
Process for the Purification of Waste Waters with Activated Carbon, W77-07093 5D
- ACTIVATED SLUDGE**
Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D
Expansion Comes Quickly to AWT Plant, W77-07009 5D
Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E
Influence of Phosphorus Removal on Solids Budget, W77-07032 5D
Some Factors Affecting Floc Formation by *Zoogloea Ramigera*, Strain I-16-M, W77-07042 5D
The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D
Plant Data Analysis of Temperature Significance in the Activated Sludge Process, W77-07046 5D
Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D
Renovated Water from Municipal Sewage Treatment Plants, W77-07086 5D
Method of Treating Waste Water with Jet Nozzles, W77-07090 5D
- ADAPTATION**
Some Significant Regularities in Plant Hydroadaptation, (In Russian), W77-06774 3B
- ADENOSINE TRIPHOSPHATE**
Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A
- ADJUSTED COSTS**
Adjustment Costs and Optimal Waste Treatment, W77-06699 5D
- ADJUSTMENT COSTS**
Adjustment Costs and Optimal Waste Treatment, W77-06699 5D
- ADSORPTION**
Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C
Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds, W77-07054 5B
Solubility and Plant Uptake of Cadmium in Soils Amended with Cadmium and Sewage Sludge, W77-07055 5B
- Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A
Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2, W77-07077 5D
- ADVECTION**
Evaporation and Advection II: Evaporation Downwind of a Boundary Separating Regions Having Different Surface Resistances and Available Energies, W77-06897 2D
- AEOLIAN SOILS**
Computing Eolian Sand Transport from Routine Weather Data, W77-06669 2L
- AERATED LAGOONS**
Stabilisation Lagoons Including Experience in Brazil. Part 1, W77-07063 5D
- AERATION**
Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G
Sewage Aeration Impeller-With Automatic De-Icing and Anti-Clogging System, W77-07001 5D
Design Criteria for Waste Water Aerator Drives, W77-07060 5D
Method of Treating Waste Water with Jet Nozzles, W77-07090 5D
- AERATOR DRIVES**
Design Criteria for Waste Water Aerator Drives, W77-07060 5D
- AERIAL PHOTOGRAPHY**
Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery, W77-06972 4A
- AEROBIC BACTERIA**
Stabilisation Lagoons Including Experience in Brazil. Part 1, W77-07063 5D
- AEROBIC DIGESTION**
Influence of Phosphorus Removal on Solids Budget, W77-07032 5D
- AEROBIC TREATMENT**
Method of Waste Treatment and Algae Recovery, W77-07003 5D
Conditioning and Land Application of Aerobically Digested Sludge, W77-07058 5D
Design Criteria for Waste Water Aerator Drives, W77-07060 5D
- AFRICA**
Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling, W77-06893 2L

SUBJECT INDEX

AFRICA

Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K

AGE

Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessa, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C

AGE CLASSES

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

AGRICULTURAL CHEMICALS

Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

AGRICULTURAL WATERSHEDS

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

AIR PLUMES

Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G

AIR POLLUTION

Pollution Prevention, Not Control Called Key to a Clean Environment, W77-06861 5G

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

AIR POLLUTION EFFECTS

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B

AIR TEMPERATURE

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B

AIRPORTS

Compressed Air for Supercooled Fog Dispersal, W77-06674 3B

ALABAMA

Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C

ALASKA

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

The Natural History and Ecology of the Bearded Seal (Erignathus Barbatus) and the Ringed Seal (Phoca (Pusa) Hispidus), W77-06799 6G

An Aerial Census of Spotted Seals, Phoca Vitulina Largha, W77-06800 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Razor Clam (Siliqua Patula, Dixon) Distribution and Population Assessment Study, W77-06830 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

SUBJECT INDEX

ANIMAL PATHOLOGY

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

Program Development Plan. Environmental Assessment of the Alaskan Continental Shelf, W77-06878 6G

Sludge Dewatering on Alaska's North Slope, W77-07030 5D

ALBERNI INLET (BRITISH COLUMBIA)

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L

ALGAE

The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C

Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C

Algal Supplement Enhancement of Static and Recirculating System, W77-06933 5C

Method of Waste Treatment and Algae Recovery, W77-07003 5D

ALGAE RECOVERY

Method of Waste Treatment and Algae Recovery, W77-07003 5D

ALGORITHMS

Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

ALLUVIAL AQUIFERS

Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

ALTERNATIVE PLANNING

Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development, W77-06634 6B

The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A

The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

ALUMINUM RECYCLING

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment, W77-07099 5D

AMMONIA

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

UNOX System for Waste Water Treatment, W77-07014 5D

AMMONIA COMPOUNDS

Apparatus and Process for Removing Ammonia Nitrogen from Waste Water, W77-07008 5D

AMMONIA TOXICITY

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

ANADROMOUS FISH

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

ANAEROBIC BACTERIA

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

ANAEROBIC CONDITIONS

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D

ANAEROBIC DIGESTERS

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

ANAEROBIC DIGESTION

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

Elimination of Anaerobic Digester Supernatant, W77-07059 5D

ANAEROBIC TREATMENT

Stabilisation Lagoons Including Experience in Brazil. Part I, W77-07063 5D

ANALOG MODELS

Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

ANALYTICAL TECHNIQUES

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

Computing Eolian Sand Transport from Routine Weather Data, W77-06669 2L

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent, W77-07045 5A

Simplified Methods of Computing the Quantity of Urban Runoff, W77-07072 5B

Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A

ANCESTRAL CHANNELS

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

ANEMONEFISH

Notes on the Nesting Success and Fecundity of the Anemonefish Amphiprion, Clarkii at Miyake-Jima, Japan, W77-06763 5C

ANGLIAN WATER AUTHORITY (ENGLAND)

The Operations Section of Lincoln Sewage Division, W77-07023 5D

ANIMAL GROWTH

Environmental Factors Affecting Survival and Growth of Vibrio Parahaemolyticus. A Review, W77-06765 5C

ANIMAL PATHOLOGY

Gas Bubble Disease of Salmonids: A Critical Review, W77-06920 5

SUBJECT INDEX

ANIMAL PATHOLOGY

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (*Oncorhynchus Nerka*), W77-06924 5C

ANIMAL PHYSIOLOGY

The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C

ANION EXCHANGE

The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F

ANNAPOLIS (MD)

Preventive Sewer Maintenance Helps Preserve Historic Annapolis, W77-06990 8G

AQUACULTURE

Algal Supplement Enhancement of Static and Recirculating System, W77-06933 5C

AQUATIC ALGAE

Nutrient Removal by Water Hyacinths, W77-07036 5G

AQUATIC ANIMALS

Optic Device for Observations of Small Organisms Under Water, (In Russian), W77-06926 7B

AQUATIC BACTERIA

The Influence of Acrolein and Hydrocrylic on the Development Dynamics of Aquatic Bacteria, W77-06690 5C

AQUATIC ENVIRONMENT

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

AQUATIC FUNGI

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

AQUATIC HABITATS

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

AQUATIC LIFE

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

AQUATIC PLANTS

The Mining Fauna in Four Macrophyte Species in Mikolajskie Lake, W77-06688 5C

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

AQUATIC POPULATIONS

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

AQUATIC PRODUCTIVITY

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

AQUEDUCT

Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

AQUEDUCTS

Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B

AQUEOUS SOLUTIONS

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

AQUICULTURE

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

AQUIFER CHARACTERISTICS

Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B

AQUIFER TESTING

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

AQUIFERS

On Large-Scale Simulation of Groundwater Flow Systems, W77-06713 4B

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

Integration of Aquifers in Flood Control Projects, W77-06723 4A

Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B

Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B

ARCTIC

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

ARGON

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater, W77-06923 5C

ARGON SOLUBILITIES

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater, W77-06923 5C

ARIZONA

Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A

Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A

ARKANSAS

Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A

AROCOLOR

Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

AROMATIC HYDROCARBONS

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

ARTIFICIAL RECHARGE

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

ASWAN DAM

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L

ASWAN HIGH DAM

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L

ATLANTIC OCEAN

Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling, W77-06893 2L

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic, W77-06911 5B

ATLANTIC SALMON

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

ATMOSPHERE

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B

Investigation of the Effects of Nonhomogeneous (or Nonstationary) Behavior on the Spectra of Atmospheric Turbulence, W77-06678 2B

ATMOSPHERIC TURBULENCE

Investigation of the Effects of Nonhomogeneous (or Nonstationary) Behavior on the Spectra of Atmospheric Turbulence, W77-06678 2B

ATTITUDES

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

SUBJECT INDEX

BASELINE STUDIES

AUSTRALIA

Purifying Water, W77-07061 5D

AUTOMATION

NASA Develops Water Monitoring System, W77-06912 5A

Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A

AVAILABLE WATER

Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington, W77-06971 4A

AVAILABLE WATER-HOLDING CAPACITY (AWHC)

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

BACKWASH TECHNIQUES

Backwashing of Granular Filters, W77-07037 5D

BACTERIA

Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C

Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A

UNOX System for Waste Water Treatment, W77-07014 5D

On the Self-Purification of Natural Waters, (In German), W77-07038 5G

Some Factors Affecting Floc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D

Ozone Oxidation of Waste Water, W77-07094 5D

BARCELONA (SPAIN)

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

BARGES

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

BARRIER ISLANDS

Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina, W77-06654 2L

Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island. Wassaw Island Erosion Study, Part III, W77-06940 8G

BASELINE STUDIES

Limnological and Planktonic Studies in the Waterton Lakes, Alberta, W77-06680 5C

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

The Natural History and Ecology of the Bearded Seal (Erignathus barbatus) and the Ringed Seal (Phoca (Pusa) hispida), W77-06799 6G

An Aerial Census of Spotted Seals, Phoca vitulina largha, W77-06800 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

SUBJECT INDEX

BASELINE STUDIES

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Razor Clam (*Siliqua patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines, W77-06850 5A

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

The New York Bight Project - 1975; Stony Brook, Long Island, New York, W77-06876 5G

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development, W77-06934 6G

Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

BASS

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

BEACHES

Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C

BEANS

Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I

BEAUFORT SEA

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

BEHAVIOR

On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A

BELGIUM (CITY OF GHENT)

Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch), W77-06681 2G

BENDING STRENGTH

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

BENTHIC FAUNA

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish), W77-06750 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C

BENTHOS

Electrically Powered Sampler for Benthic Macroinvertebrates, W77-06757 7B

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

BERING SEA

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

An Aerial Census of Spotted Seals, *Phoca vitulina largha*, W77-06800 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

SUBJECT INDEX

BIRDS

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

BIBLIOGRAPHIES

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F

Coastal Zone Management, Annotated Bibliography, W77-06937 2L

Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D

Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry, W77-06951 5D

BIOASSAY

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in Ictalurus punctatus (Channel Catfish), W77-06759 5C

The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C

BIOCHEMICAL OXYGEN DEMAND

Waste Treatment Apparatus, W77-07005 5D

Nutrient Removal by Water Hyacinths, W77-07036 5G

The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

Waste Treatment Process, W77-07091 5D

BIOCHEMISTRY

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

BIODEGRADATION

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

BIOGENIC ELEMENTS

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

BIOINDICATORS

Evaluation of Potential Indicators of Sublethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A

An Offshore Biomonitoring System for Chlorinated Hydrocarbons, W77-06641 5A

The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C

Indicator Values of Vascular Plants in Central Europe, (In German), W77-06803 2I

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

Escherichia Coli as a Sanitary-Indicator Microorganism, (In Russian), W77-07067 5A

BIOLOGICAL COMMUNITIES

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

Limnological and Planktonic Studies in the Waterton Lakes, Alberta, W77-06680 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish), W77-06750 5C

BIOLOGICAL TREATMENT

Waste Treatment Apparatus, W77-07005 5D

Plug-In Concept for Pilot Sewage Treatment Plant, W77-07026 5D

Upgrading Biological Sewage Treatment Plants Today, W77-07062 5D

Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D

BIOMASS

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A

Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A

Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character, W77-06685 5C

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle, W77-06692 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C

Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A

BIRDS

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

SUBJECT INDEX

BIRDS

- Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G
- Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G
- A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G
- BISCAYNE AQUIFER (FLA)**
Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B
- BONDING**
Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G
- BORER FAUNA**
The Mining Fauna in Four Macrophyte Species in Mikolajskie Lake, W77-06688 5C
- BOTTOM SAMPLING**
A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A
- The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C
- Electrically Powered Sampler for Benthic Macroinvertebrates, W77-06757 7B
- BOTTOM SEDIMENTS**
Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B
- BRINE DISPOSAL**
Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A
- BRINES**
Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K
- BRISTOL BAY**
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G
- BRISTOL BAY (ALAS)**
Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G
- BRISTOL BAY BASIN (ALAS)**
Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G
- BRITISH COLUMBIA**
The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L
- BROWN TROUT**
Toxicity of Fluoride to Brown Trout Fry (*Salmo trutta*), W77-06628 5C
- BUBBLES**
In Situ Acoustic Measurements of Microbubbles at Sea, W77-06916 2L
- BUDGETING**
The Operations Section of Lincoln Sewage Division, W77-07023 5D
- BYPRODUCTS**
State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D
- CADMIUM**
The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C
- Solubility and Plant Uptake of Cadmium in Soils Amended with Cadmium and Sewage Sludge, W77-07055 5B
- CALANOID COPEPOD**
Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Midwater Copepod *Gaussia* Princeps, W77-06642 5C
- CALCIUM**
Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C
- Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G
- CALIBRATION**
A Universal Calibration Equation for Price Meters and Similar Instruments, W77-06943 7B
- CALIFORNIA**
Monitoring the Marine Environment Through Sedimentation, W77-06651 2L
- Cost Comparison Between Subterranean and Current Tunneling Methods, W77-06662 8A
- Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A
- Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix B--Subterranean Cost Analyses, W77-06664 8A
- Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A
- USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G
- Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C
- In Situ Acoustic Measurements of Microbubbles at Sea, W77-06916 2L
- Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D
- CALLITRICHE-OBTUSANGULA**
Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C
- CANADA**
A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B
- Presenting Trends in Lake Eutrophication, W77-06693 5C
- Devon Island Ice Cap: Core Stratigraphy and Paleoclimate, W77-06890 2C
- The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L
- The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L
- Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B
- Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A
- Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D
- Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario, W77-06950 5D
- Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry, W77-06951 5D
- Canwel Can Do, W77-06985 5D
- The Chemical Characteristics of the City of Winnipeg Waste Water, W77-07047 5A
- CANADA WATER ACT REGULATIONS**
Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A
- CANALS**
Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

SUBJECT INDEX

CHUKCHI SEA

CAPE THOMPSON (ALAS)

- A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

CAPITAL INVESTMENT

- The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

CAPPED WELLS

- Bits and Pieces, W77-06866 8G

CARASSIUS AURATUS

- Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

CARP

- A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

- Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

- Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C

- Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*, W77-06780 5C

- Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H

CATFISH

- Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

CAVE CREEK (AZ)

- Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A

CAVITATION

- Method of Applying Ozone and Sonic Energy to Sterilize and Oxidize Waste Water, W77-07007 5D

CEMENTS

- Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

CENTRAL ARIZONA PROJECT

- Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E

CENTRIFUGATION

- Sludge Dewatering on Alaska's North Slope, W77-07030 5D

CESSPOOLS

- The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D

CHANDELEUR ISLANDS (LA)

- Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

CHANNEL CATFISH

- Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

CHANNEL IMPROVEMENT

- Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations, W77-06676 4A

CHANNEL ROUTING

- Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

CHANNELS

- On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A

CHEMICAL ANALYSIS

- Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

- Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent, W77-07045 5A

CHEMICAL GROUTING

- Testing and Grouting Leaking Joints, W77-06986 8G

CHEMICAL PROPERTIES

- Mineral Content of Selected Geothermal Waters, W77-06667 3E

- The Chemical Characteristics of the City of Winnipeg Waste Water, W77-07047 5A

CHEMICAL THERMOMETERS

- Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

CHEMICAL TREATMENT

- Plug-In Concept for Pilot Sewage Treatment Plant, W77-07026 5D

- Purifying Water, W77-07061 5D

- Upgrading Biological Sewage Treatment Plants Today, W77-07062 5D

CHEMISTRY

- Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

CHEMISTRY OF PRECIPITATION

- The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.; Theory and Quantitative Models, W77-06675 2B

CHESAPEAKE BAY

- Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

CHICAGO (ILL)

- Chicago Drives Large Bores to Control Combined Sewage Flow, W77-06988 8E

CHINOOK SALMON

- Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

CHLORINATED HYDROCARBONS

- An Offshore Biomonitoring System for Chlorinated Hydrocarbons, W77-06641 5A

CHLORINATION

- Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton, W77-06637 5C

- How to Deal with Pitting and Corrosion, W77-06869 8G

- The Current Role of Wastewater Disinfection, W77-07064 5D

CHLORINE

- Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton, W77-06637 5C

CHLOROPHYLL

- Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

CHROMATOGRAPHY

- Characterization of Soluble Organic Matter in Leachate, W77-07039 5A

CHROMIUM

- Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (*Salmo Gairdneri*), W77-06639 5C

CHUKCHI SEA

- Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

- The Natural History and Ecology of the Bearded Seal (*Erignathus Barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

- Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

- Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

- Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

SUBJECT INDEX

CHUKCHI SEA

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound.
W77-06848 6G

CHUM SALMON

The Growth of Young Salmonids (Onchorhynchus Keta): Controlled Ecosystem Pollution Experiment,
W77-06618 5A

CINCINNATI METROPOLITAN SEWER DISTRICT (OH)

Cincinnati's Preventive Maintenance Sewer Program.
W77-06989 5G

CIRCULATION

Mixing and Circulation of Lakes and Reservoirs with Air Plumes,
W77-06633 5G

The Observed Winter Circulation of Lake Ontario,
W77-06655 2H

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast,
W77-06907 2L

CITY PLANNING

Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development,
W77-06634 6B

CLAMS

Razor Clam (Siliqua Patula, Dixon) Distribution and Population Assessment Study,
W77-06830 6G

Effects of Engineering Activities on the Ecology of Pismo Clams,
W77-06886 5C

CLAYS

Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition,
W77-06872 2G

CLEANING

Cincinnati's Preventive Maintenance Sewer Program.
W77-06989 5G

Preventive Sewer Maintenance Helps Preserve Historic Annapolis.
W77-06990 8G

Copper Sulfate Fights Root Growth in Sewer Systems,
W77-06991 8G

Contract Services Stretch Sewer Maintenance Budget,
W77-06994 8G

Backwashing of Granular Filters,
W77-07037 5D

CLEAR LAKE (CALIF)

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution,
W77-06697 5C

CLIMATES

Indicator Values of Vascular Plants in Central Europe, (In German),
W77-06803 2I

CLIMATOLOGY

Climatology for Geographers,
W77-06659 2B

Devon Island Ice Cap: Core Stratigraphy and Paleoclimate,
W77-06890 2C

CLINTON QUADRANGLE (OKLA)

Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma,
W77-06959 7C

CLOUD SEEDING

Weather Modification in the Soviet Union--1976,
W77-06644 3B

On the Status of Hail Suppression,
W77-06645 3B

CLYDE SEA (SCOTLAND)

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3),
W77-06668 5B

COAGULATION

Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2,
W77-07077 5D

Renovated Water from Municipal Sewage Treatment Plants,
W77-07086 5D

COAL CONVERSION

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

COAL LIQUEFICATION

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

COAL MINE WASTES

Debris Basins for Control of Surface Mine Sedimentation,
W77-06672 5G

COASTAL ZONE MANAGEMENT

State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development,
W77-06934 6G

Who's Minding the Shore. A Citizens' Guide to Coastal Management,
W77-06935 5G

Coastal Zone Management, Annotated Bibliography,
W77-06937 2L

COASTS

Monitoring the Marine Environment Through Sedimentation,
W77-06651 2L

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca,
W77-06875 5C

Continental Shelf Waves and Alongshore Variations in Bottom Topography and Coastline,
W77-06891 2L

Incipient Sediment Motion in Entrances with Shell Beds,
W77-06930 2L

Coastal Zone Management, Annotated Bibliography,
W77-06937 2L

COD

Rotary-Flow Technique for Testing Fitness of Fish,
W77-06608 5C

COHO SALMON

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green,
W77-06746 5C

COLLECTIVE UTILITY

Collective Utility: A Systems Approach to Water Pricing Policy,
W77-06712 6C

COLORADO

New Design Gives Denver District Iron-Free Well,
W77-06868 8A

Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72.
W77-07076 5A

COLORADO RIVER BASIN

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

COLUMBIA RIVER

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka),
W77-06924 5C

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969,
W77-06925 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974),
W77-06927 5C

COMBINED SEWERS

Chicago Drives Large Bores to Control Combined Sewage Flow.
W77-06988 8E

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows,
W77-07031 5D

Treatment of Combined Sewer Overflows Via Thin Film Chemistry,
W77-07034 5D

Short Course Proceedings: Applications of Stormwater Management Models,
W77-07066 5B

On-Line Adaptive Control for Combined Sewer Systems,
W77-07100 5D

COMMUNICATION CHANNELS

Environmental Pollution: Is There Enough Public Concern to Lead to Action,
W77-06955 6G

COMPARATIVE PRODUCTIVITY

The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German),
W77-06962 3F

SUBJECT INDEX

COPEPODS

COMPOSTING

- Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

COMPREHENSIVE PLANNING

- A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines, W77-06850 5A

COMPUTER MODELS

- A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C
Hybrid Computer Analysis of a Combined Surface Water-Groundwater System, W77-06729 4B
Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C
On-Line Adaptive Control for Combined Sewer Systems, W77-07100 5D

COMPUTER PROGRAMS

- Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

CONDUCTIVITY

- The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C

CONFERENCES

- Conference on Research in Tunneling and Excavation Technology, W77-06885 8E
Advanced Waste Treatment Seminar, Session III, Removal of Solids and Organics, Held at San Francisco, on October 28-29, 1970, W77-07074 5D

CONJUNCTIVE USE

- Integration of Aquifers in Flood Control Projects, W77-06723 4A

CONJUNCTIVE USE

- The Conjunctive Use of a Multi-Reservoir System and a Dual-Purpose Desalting Plant, W77-06714 4B
Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B
Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B

CONNECTICUT

- Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A

CONOWINGO CREEK (MD-PA)

- Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

CONSERVATION

- Place and Role of Plant Cover in Optimization of the Donbas Natural Environment, (In Ukrainian), W77-06858 4C

- Energy Conservation and Heat Recovery in Waste Water Treatment Plants, W77-07024 5D

CONSTRUCTION

- Fast-Tracking Cuts Costs 16% on Advanced Waste Water Plant, W77-07016 5D
Waste Water Treatment Plant Built in Wet Hole, W77-07021 5D

CONSTRUCTION COSTS

- Fast-Tracking Cuts Costs 16% on Advanced Waste Water Plant, W77-07016 5D
Waste Water Treatment Plant Built in Wet Hole, W77-07021 5D

CONSTRUCTION EQUIPMENT

- Waste Water Treatment Plant Built in Wet Hole, W77-07021 5D

CONSTRUCTION MATERIALS

- Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D
Waste Water Treatment Plant Built in Wet Hole, W77-07021 5D

CONTINENTAL SHELF

- Program Development Plan. Environmental Assessment of the Alaskan Continental Shelf, W77-06878 6G
Continental Shelf Waves and Alongshore Variations in Bottom Topography and Coastline, W77-06891 2L
An Analysis of Inertial Oscillations Observed Near Oregon Coast, W77-06892 2L
Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling, W77-06893 2L

CONTROL

- Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A
Design and Control of Secondary Settlement Tanks, W77-07015 5D

CONTROL RULES

- Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

CONTROL STRUCTURES

- Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

CONTROL SYSTEMS

- Study of Leachate at Landfill Sites 1975, Volume 1, W77-06851 5B

CONTROLLED EXPERIMENTAL ECOSYSTEM

- Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A
Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A
Evaluation of Potential Indicators of Sublethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A
The Growth of Young Salmonids (Onchorhynchus Keta): Controlled Ecosystem Pollution Experiment, W77-06618 5A

- Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A

- Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

- Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

CONTROLLED EXPERIMENTAL ECOSYSTEMS

- Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A
Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A
Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A
Loch Ewe Bag Experiment, 1974, W77-06627 5A

COOLING WATER

- Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton, W77-06637 5C
The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C

COPEPODS

- Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A

SUBJECT INDEX

COPEPODS

- Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*, W77-06642 5C

COPPER

- Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A
- Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A
- The Growth of Young Salmonids (*Onchorhynchus Keta*): Controlled Ecosystem Pollution Experiment, W77-06618 5A
- Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A
- Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A
- Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A
- Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A
- Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A
- Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A
- Loch Ewe Bag Experiment, 1974, W77-06627 5A
- The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa Muller*, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C
- Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C

COPPER ION

- Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A

COPPER SULFATE

- Copper Sulfate Fights Root Growth in Sewer Systems, W77-06991 8G

CORAL

- Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

CORAL REEF GROOVE

- Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

CORPUS CHRISTI (TX)

- Control Sewer Corrosion with H2O2, W77-06993 8G

CORROSION

- Pumping Systems: The Simpler, The Better, W77-06856 8C
- New Design Gives Denver District Iron-Free Well, W77-06868 8A
- Control Sewer Corrosion with H2O2, W77-06993 8G

CORROSION CONTROL

- How to Deal with Pitting and Corrosion, W77-06869 8G
- Control Sewer Corrosion with H2O2, W77-06993 8G

COST ANALYSIS

- Cost Comparison Between Subterrene and Current Tunneling Methods, W77-06662 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix B--Subterrene Cost Analyses, W77-06664 8A

COST COMPARISONS

- Cost Comparison Between Subterrene and Current Tunneling Methods, W77-06662 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix B--Subterrene Cost Analyses, W77-06664 8A

COSTS

- Subsurface Injection-How Much Does It Cost, W77-07011 5E
- Municipal Waste Water Treatment as an Industrial Operation, W77-07025 5D

COTTON

- The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F

CRABTREE CREEK WATERSHED (NC)

- Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

CRANKCASE WASTES

- Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

CROP MANAGEMENT PRACTICES

- The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

CROP PRODUCTION

- The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

CROP RESPONSE

- Salinity Effects on Rice After the Boot Stage, W77-06871 3C
- The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F

CRUSTACEANS

- Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C
- Algal Supplement Enhancement of Static and Recirculating System, W77-06933 5C

CTENOPHORES

- Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A

CUBIC SPLINES

- Smoothing Data with Cubic Splines, W77-06831 7C

CULTIVATION

- The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

CUNNERS

- Respiratory Response of Cunners to Silver, W77-06789 5C

CURRENTS (WATER)

- Lake Currents and Temperatures Near the Western Shore of Lake Michigan, W77-06687 2H
- Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L
- Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L

CURVES

- Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B

CUTTHROAT TROUT

- A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

CYANOPHYTA

- The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution, W77-06697 5C

CYCLING NUTRIENTS

- Loch Ewe Bag Experiment, 1974, W77-06627 5A

SUBJECT INDEX

DEEP WELLS

- Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H
- CYTOLOGICAL STUDIES**
- Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C
- Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I
- DAIRY INDUSTRY**
- Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G
- DAM CONSTRUCTION**
- Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D
- DAMS**
- Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C
- DATA COLLECTION**
- Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C
- DATA COLLECTIONS**
- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G
- Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G
- Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G
- The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G
- An Aerial Census of Spotted Seals, *Phoca vitulina largha*, W77-06800 6G
- Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G
- Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped-Fish Relationships in the Bering Sea, W77-06806 6G
- Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G
- Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G
- Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G
- Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G
- Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G
- Ecology and Behavior of Southern Hemisphere Shearwaters (Genus *Puffinus*) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G
- Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G
- Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G
- Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G
- Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G
- Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G
- Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G
- A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G
- Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G
- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G
- Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G
- Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G
- Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G
- Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G
- Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G
- Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G
- Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G
- Beaufort Sea Estuarine Fishery Study, W77-06840 6G
- Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G
- Littoral Drift Estimates Along the Coastline of Florida, W77-06882 2L
- DATA PROCESSING**
- Smoothing Data with Cubic Splines, W77-06831 7C
- The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L
- DATA TRANSFER**
- Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A
- DDT**
- An Offshore Biomonitoring System for Chlorinated Hydrocarbons, W77-06641 5A
- DEBRIS BASINS**
- Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G
- DECIDUOUS FORESTS**
- A Model for the Water Regime of a Deciduous Forest with Special Consideration of the Functional Interrelationships Among Meteorological Factors, Soil Water Content and Evapotranspiration, (In German), W77-06864 2A
- DECISION MAKING**
- Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E
- Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G
- Subsurface Injection-How Much Does It Cost, W77-07011 5E
- DEEP WELLS**
- Submersible Pump Design: Dependent on Well Diameter and Depth, W77-06867 8C

SUBJECT INDEX

DEFICIENT ELEMENTS

DEFICIENT ELEMENTS

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

DEGASSING TECHNIQUES

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

DEHYDRATION

Some Significant Regularities in Plant Hydroadaptation, (In Russian), W77-06774 3B

DELAWARE RIVER

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

DELMARVA PENINSULA

Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery, W77-06972 4A

DELTA

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

DEMONSTRATION WATERSHEDS

An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

DENSITY STRATIFICATION

Waste Injection into Stratified Ground Water Bodies, W77-06855 5B

DENVER (COLORADO)

New Design Gives Denver District Iron-Free Well, W77-06868 8A

DEPTH-AREA CURVES

Area-Depth Relations for Frequency Values of Rainfall, W77-06647 2B

DEPTH-AREA-DURATION ANALYSIS

Area-Depth Relations for Frequency Values of Rainfall, W77-06647 2B

DESALINATION PLANTS

The Conjunctive Use of a Multi-Reservoir System and a Dual-Purpose Desalting Plant, W77-06714 4B

DESIGN

Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C

A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

DESIGN CRITERIA

Design and Control of Secondary Settlement Tanks, W77-07015 5D

Elimination of Anaerobic Digester Supernatant, W77-07059 5D

Design Criteria for Waste Water Aerator Drives, W77-07060 5D

Stabilisation Lagoons Including Experience in Brazil. Part 1, W77-07063 5D

Advanced Waste Treatment Seminar, Session III, Removal of Solids and Organics, Held at San Francisco, on October 28-29, 1970. W77-07074 5D

DESIGN FLOOD

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River. W77-06953 4A

DETERGENTS

Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A

DEVELOPING COUNTRIES (GROUNDWATER)

Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F

DEWATERING

Screenings Dewatering Press. W77-07029 5D

Sludge Dewatering on Alaska's North Slope, W77-07030 5D

The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D

Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D

Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D

Factors Influencing the Dewatering Characteristics of Sludge, W77-07097 5D

DEWATERING PRESS

Screenings Dewatering Press. W77-07029 5D

DICKEY-LINCOLN SCHOOL LAKE PROJECT (ME)

Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D

DIFFUSION COEFFICIENT

Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

DIGHA (INDIA)

A Study to Forecast the Waves at Digha, W77-06648 2L

DIPTERA

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C

DIRECT SEARCH METHOD

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

DISASTERS

Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G

DISCRIMINANT ANALYSIS

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

DISEASES

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

DISINFECTION

Water Decontamination in Northern Regions by Impulse Electric Charges, (In Russian), W77-06791 5D

The Current Role of Wastewater Disinfection, W77-07064 5D

DISPERSION

A Test Particle Dispersion Study in Massachusetts Bay. W77-06880 2L

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

DISSOLVED GAS CONTENT

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

DISSOLVED GASES

Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. 1. Dissolved Gases, W77-06900 5B

DISSOLVED OXYGEN

Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

DISSOLVED SOLIDS

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

SUBJECT INDEX

ECOLOGICAL DISTRIBUTION

DISTRIBUTION

Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 21

DISTRIBUTION PATTERNS

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 21

Temperature Relations of Puget Sound Thais in Reference to Their Intertidal Distribution, W77-06767 5C

Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C

Dispersal and Dispersion of Pond Snails in an Experimental Environment Varying to Three Factors, Singly and in Combination, W77-06773 5C

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Razor Clam (*Siliqua patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

DOMESTIC WASTES

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

Canwel Can Do, W77-06985 5D

Hydrocarbon Products Manufacture--By Carbonisation of Coal, Scrap Rubber or Plastic or Domestic Sewage Under Reduced Pressure, W77-07000 5D

The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D

Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2, W77-07077 5D

Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

DONETSK (UKRAINIAN SSR)

Experience in Treating Waste Waters from the Donetsk Mines, (In Russian), W77-07068 5D

DORR TYPE CLARIFIER

Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D

DRAINAGE

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G

DRAINAGE SYSTEMS

London's Stormwater Problem, W77-06983 5D

DRAWDOWN

Hydraulics and Economics of Well Field Layout, W77-06863 8B

DRILLING EQUIPMENT

Make Wire Rope Last-Treat it Like a Machine, W77-06857 8G

One Good Idea Spurs Another. W77-06860 8C

DRILLING PIPE CLAMPS

One Good Idea Spurs Another. W77-06860 8C

DROUGHT RESISTANCE

Some Significant Regularities in Plant Hydroadaptation, (In Russian), W77-06774 3B

DROUGHT TOLERANCE

Some Significant Regularities in Plant Hydroadaptation, (In Russian), W77-06774 3B

DRYING

Causes of the Drying up of Forests in the Flood Plain of the Lower Reaches of the Ural River, (In Russian), W77-06801 4D

Drying Potato Wastes for Animal Feed as an Alternative Disposal Method. W77-06947 5D

DYES

Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L

DYNAMIC PROGRAMMING

The Conjunctive Use of a Multi-Reservoir System and a Dual-Purpose Desalting Plant, W77-06714 4B

Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A

DYNAMICS

Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D

E COLI

Escherichia coli as a Sanitary-Indicator Microorganism, (In Russian), W77-07067 5A

ECHINODERMS

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

ECOLOGICAL DISTRIBUTION

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds. W77-06793 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

An Aerial Census of Spotted Seals, *Phoca vitulina largha*, W77-06800 6G

ECOLOGICAL DISTRIBUTION

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding

Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

ECOLOGY

Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations, W77-06676 4A

Indicator Values of Vascular Plants in Central Europe, (In German), W77-06803 2I

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

Place and Role of Plant Cover in Optimization of the Donbas Natural Environment, (In Ukrainian), W77-06858 4C

ECONOMIC EFFICIENCY

Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G

Hydraulics and Economics of Well Field Layout, W77-06863 8B

Water Quality Management and the Distribution of Emission Rights by Sealed Tender Markets, W77-06976 5E

ECONOMIC GROWTH

An Input-Output Analysis of Environmental Preservation, W77-06706 6G

ECONOMICS

A Sector Model for Regional and National Water Resources Planning, W77-06731 6A

Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B

ECOSYSTEMS

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G

Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

ECOTYPES

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

EFFECTS

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L

EFFICIENCIES

Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A

EFFLUENTS

The Generation of Residual Flows in Norway: An Input-Output Approach, W77-06698 5G

Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D

Water Quality Management and the Distribution of Emission Rights by Sealed Tender Markets, W77-06976 5E

EGYPT

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L

EIFFEL MOUNTAINS (GERMANY)

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

EKMAN-TYPE MODELS

Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H

EL PASO AREA (TEX)

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeeth Counties, Texas, W77-06970 4B

ELASTIC MODULUS

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

ELASTICITY (MECHANICAL)

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

SUBJECT INDEX

ENVIRONMENTAL EFFECTS

ELECTRIC MOTORS

- It's All on the Nameplate: Everything You Always Wanted to Know About Jet Pumps, W77-06854 8C

ELECTRIC POWER PRODUCTION

- The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C
- Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish), W77-06755 5C
- The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C

ELECTRICAL EQUIPMENT

- Pumping Systems: The Simpler, The Better, W77-06856 8C

ELECTRICAL WELL LOGGING

- Electric Logging, W77-06865 8G

ELECTROLYSIS

- Water Decontamination in Northern Regions by Impulse Electric Charges, (In Russian), W77-06791 5D

- The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

ELECTROLYTES

- The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C

ELECTRON TREATMENT

- Treatment of Sewage by Electrons and Gammas, W77-07012 5D

ELECTRONIC EQUIPMENT

- Bits and Pieces, W77-06866 8G

EMBRYOGENESIS

- LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

EMBRYONIC GROWTH STAGE

- LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

ENERGY

- Evaporation and Advection II: Evaporation Downwind of a Boundary Separating Regions Having Different Surface Resistances and Available Energies, W77-06897 2D
- Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G
- Energy Conservation and Heat Recovery in Waste Water Treatment Plants, W77-07024 5D

ENERGY BUDGET

- Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

ENERGY DEVELOPMENT

- Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

ENO RIVER WATERSHED (NC)

- Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

ENTEROVIRUSES

- Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

ENVIRONMENTAL ASSESSMENT

- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G

- Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

- Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G

- The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

- Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

- Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

- Razor Clam (*Siliqua Patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

- Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

- Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

- Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

- Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

- Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

- Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

- Beaufort Sea Estuarine Fishery Study, W77-06840 6G

- The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

- Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

- Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

- Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

- Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

- Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

- Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

- The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

- Program Development Plan. Environmental Assessment of the Alaskan Continental Shelf, W77-06878 6G

ENVIRONMENTAL CONTROL

- Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

ENVIRONMENTAL DEVELOPMENT

- Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

ENVIRONMENTAL EFFECTS

- The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

- Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

- The Fauna of the Polluted River Tees Estuary, W77-06638 5C

- Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G

- Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G

- Fish Diseases and Parasites in Relation to the Environment, W77-06744 5C

- The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C

- Environmental Factors Affecting Survival and Growth of *Vibrio Parahaemolyticus*. A Review, W77-06765 5C

SUBJECT INDEX

ENVIRONMENTAL EFFECTS

Growth and Movement of Fish in the Vicinity of a Thermal Discharge, W77-06766 5C

Temperature Relations of Puget Sound Thais in Reference to Their Intertidal Distribution, W77-06767 5C

Seasonal changes in the Respiration of Pumpkinseed, *Lepomis Gibbosus*, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C

Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L.), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C

The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C

Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C

Dispersal and Dispersion of Pond Snails in an Experimental Environment Varying to Three Factors, Singly and in Combination, W77-06773 5C

Health Effects of Multipurpose Use of Water, W77-06775 5C

Long-Term Lead Accumulation in Abalone (*Haliotis* Spp.) Fed on Lead-Treated Brown Algae (*Egregia Laevigata*), W77-06776 5C

Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C

Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C

Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*, W77-06780 5C

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-06782 5C

Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C

A Preliminary Survey of Mercury in Fish from Bombay and Thana Environment, W77-06785 5C

Changes in the Structure of Phytoplankton During the First Years of Existence of the Dardap Storage Reservoir, (In Serbo-Croatian), W77-06786 2H

Laboratory Studies on the Effect of Metals on Oxygen Uptake by Sewage Sludge in Brackish Water, W77-06788 5C

Respiratory Response of Cunners to Silver, W77-06789 5C

Heavy Metals in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W77-06790 5C

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds. W77-06793 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

The Natural History and Ecology of the Bearded Seal (*Erignathus Barbatus*) and the Ringed Seal (*Phoca (Pusa) Hispidus*), W77-06799 6G

An Aerial Census of Spotted Seals, *Phoca Vitulina Largha*, W77-06800 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus *Puffinus*) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral. W77-06825 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

SUBJECT INDEX

EQUATIONS

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Razor Clam (*Siliqua Patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines, W77-06850 5A

The New York Bight Project - 1975; Stony Brook, Long Island, New York, W77-06876 5G

Guidelines for the Preparation of Environmental Reports for Fossil-Fueled Steam Electric Generating Stations, W77-06918 6G

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development, W77-06934 6G

Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

Coastal Facility Guidelines: A Methodology for Development with Environmental Case Studies on Marinas and Power Plants, W77-06936 6G

ENVIRONMENTAL EFFECTS. WATER RESOURCE

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

ENVIRONMENTAL ENGINEERING

Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D

ENVIRONMENTAL IMPACT

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Razor Clam (*Siliqua Patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

ENVIRONMENTAL IMPACT STATEMENTS

Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E

Guidelines for the Preparation of Environmental Reports for Fossil-Fueled Steam Electric Generating Stations, W77-06918 6G

ENVIRONMENTAL QUALITY

An Input-Output Analysis of Environmental Preservation, W77-06706 6G

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

ENVIRONMENTAL SANITATION

Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D

ENZYMES

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

EPA STORMWATER MANAGEMENT MODEL (SWMM)

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

EQUATIONS

Simple Formulae for the Estimation of Wet Bulb Temperature and Precipitable Water, W77-06646 2B

SUBJECT INDEX

EQUATIONS

- Profiles and Evaporation,
W77-06898 2D
- A Universal Calibration Equation for Price Me-
ters and Similar Instruments,
W77-06943 7B

- Comparison of Iterative Methods of Solving
Two-Dimensional Groundwater Flow Equa-
tions,
W77-06965 2F

EQUIPMENT

- Electrically Powered Sampler for Benthic
Macroinvertebrates,
W77-06757 7B

- Testing and Grouting Leaking Joints,
W77-06986 8G

- Preventive Sewer Maintenance Helps Preserve
Historic Annapolis.
W77-06990 8G

- Electron-Beam Irradiation of Waste Products--
e.g., For Sterilization of Sewage Sludge and
Waste Industrial Products.
W77-06997 5D

EROSION

- Characteristics of Water Flow at the North End
of the Wassaw Barrier Island Complex. Was-
saw Island Erosion Study, Part II,
W77-06939 2J

- Changing Needs and Opportunities in the Sedi-
ment Field,
W77-06964 2J

EROSION CONTROL

- An Executive Summary of Three EPA Demon-
stration Programs in Erosion and Sediment
Control,
W77-06671 5G

- Debris Basins for Control of Surface Mine
Sedimentation,
W77-06672 5G

- Antierosion Role of Forest Plantings in the
Steppe Zone of the Moldavian SSR, (In Rus-
sian),
W77-06745 4C

- Sand Stabilization on the Dunes, Beach and
Shoreface of a Historically Eroding Barrier
Island. Wassaw Island Erosion Study, Part III,
W77-06940 8G

- Diminution Ratios for Planning Construction-
Area Sediment Controls,
W77-06980 4D

EROSION HAZARD

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

- Oregon's Long Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

ESTIMATING

- Current Methods Used in the Soil Conservation
Service to Estimate Sediment Yield,
W77-06657 4D

ESTUARIES

- The Fauna of the Polluted River Tees Estuary,
W77-06638 5C

- Beaufort Sea Estuarine Fishery Study,
W77-06840 6G

- Investigation of Flushing Time in the Lafayette
River, Norfolk, Virginia,
W77-06881 2L

- The Influence of Wind on the Surface Layer of
a Stratified Inlet: Part I. Observations,
W77-06894 2L

- The Influence of Wind on the Surface Layer of
a Stratified Inlet: Part II. Analysis,
W77-06895 2L

- A Device for Measuring Seepage Flux in Lakes
and Estuaries,
W77-06903 7B

- Nutrients, Chlorophyll, and Internal Tides in
the St. Lawrence Estuary,
W77-06910 5B

- Incipient Sediment Motion in Entrances with
Shell Beds,
W77-06930 2L

- Mississippi Sound Temporal and Spatial Dis-
tribution of Nutrients,
W77-06932 5B

- Coastal Zone Management, Annotated Bibliog-
raphy,
W77-06937 2L

- Blank and Salinity Corrections for Automated
Nutrient Analysis of Estuarine and Sea Waters,
W77-06938 5A

- Measurement in a Marine Environment Using
Low Cost Sensors of Temperature and Dis-
solved Oxygen,
W77-06960 7B

ETHANOL

- Rotary-Flow Technique for Testing Fitness of
Fish,
W77-06608 5C

EUPHOTIC ZONE

- Temperature, Salinity and Light Penetration
Structures: Controlled Ecosystem Pollution Ex-
periment,
W77-06626 5A

EUROPE

- Indicator Values of Vascular Plants in Central
Europe, (In German),
W77-06803 2I

EUTROPHICATION

- Presenting Trends in Lake Eutrophication,
W77-06693 5C

- Long-Term Changes of the Pelagic Primary
Production in Heated Lakes, (In Polish),
W77-06755 5C

- Distribution and Indicatory Value of the Sub-
merged Macrophytes in the Flowing Waters of
the Friedberger Au, (In German),
W77-06802 5C

- Monroe Reservoir, Indiana, Part I: Hydrologic
Circulation, Sedimentation, and Water Chemis-
try Part II: Nutrient Relations,
W77-06982 5C

- Nutrient Removal by Water Hyacinths,
W77-07036 5G

EVALUATION

- A Sector Model for Regional and National
Water Resources Planning,
W77-06731 6A

- Hydrological Evaluation of Changes in Runoff
Characteristics,
W77-06732 4A

EVAPORATION

- Lake St. Clair Hydrologic Transfer Factors.
W77-06879 2H

- Evaporation and Advection II: Evaporation
Downwind of a Boundary Separating Regions
Having Different Surface Resistances and
Available Energies,
W77-06897 2D

- Profiles and Evaporation,
W77-06898 2D

- Comprehensive Monitoring of Meteorology,
Hydraulics, and Thermal Regime of the San
Diego Aqueduct, California,
W77-06973 2D

EXCAVATION

- Conference on Research in Tunneling and Ex-
cavation Technology,
W77-06885 8E

EXPERIMENTAL SYSTEM IDENTIFICATION

- On the Application of Optimization Techniques
to Conceptual Catchment Models,
W77-06709 2A

FALLOUT

- The Distribution of Natural and Anthropogenic
Elements and Compounds in Precipitation
Across the U.S.; Theory and Quantitative
Models,
W77-06675 2B

FARM LAGOONS

- Pollutant Movement to Shallow Ground Water
Tables from Swine Waste Lagoons,
W77-06742 5B

FARM WASTES

- Pollutant Movement to Shallow Ground Water
Tables from Swine Waste Lagoons,
W77-06742 5B

FECUNDITY

- Notes on the Nesting Success and Fecundity of
the Anemonefish Amphiprion Clarkii at
Miyake-Jima, Japan,
W77-06763 5C

FEEDS

- Drying Potato Wastes for Animal Feed as an
Alternative Disposal Method.
W77-06947 5D

FERTILIZATION

- Potassium in an Arid Loessial Soil: Changes in
Availability as Related to Cropping and Fer-
tilization,
W77-06870 3F

SUBJECT INDEX

FLOCCULATION

FERTILIZERS

Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization, W77-06870 3F

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

Agricultural Disposal of Aerobic Wastewater Sludges in an Urban County, W77-07057 5D

FIBERGLASS WELL CASING

New Design Gives Denver District Iron-Free Well, W77-06868 8A

FIELD CAPACITY

A Method of Evaluating a Field Water Capacity Using PF-3, (In French), W77-06844 2G

FILMS

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

FILTERS

Backwashing of Granular Filters, W77-07037 5D

Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D

FILTRATION

Backwashing of Granular Filters, W77-07037 5D

Characterization of Soluble Organic Matter in Leachate, W77-07039 5A

Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2, W77-07077 5D

Process Technological Background Regarding New Protective Regulations of Water Bodies-Results of Nitrification and Phosphorus Elimination Experiments in Zurich and Bern. III. Filtration by Flocculation for the Elimination of Phosphorus from Communal Waste Water (Verfahrenstechnische Unterlagen im Hinblick auf die neuen Gewässerschutzanforderungen-Ergebnisse der Versuche ueber die Nitrifikation und Phosphorelimination in Zuerich und Bern. III. Flockungsfiltration zur Elimination von Phosphor aus Kommunalem Abwasser), W77-07082 5D

FINITE-DIFFERENCE EQUATIONS

Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations, W77-06965 2F

FISH

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

FISH BARRIERS

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

FISH BEHAVIOR

A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

FISH DISEASE

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

FISH DISEASES

Fish Diseases and Parasites in Relation to the Environment, W77-06744 5C

Gas Bubble Disease of Salmonids: A Critical Review, W77-06920 5

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

FISH EGGS

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

FISH FITNESS

Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C

FISH FOOD ORGANISMS

The Growth of Young Salmonids (Oncorhynchus Keta): Controlled Ecosystem Pollution Experiment, W77-06618 5A

FISH HATCHERIES

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

Gas Bubble Disease of Salmonids: A Critical Review, W77-06920 5

FISH KILL

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

FISH MIGRATION

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

FISH PATHOLOGY

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

FISH PHYSIOLOGY

The Accumulation of Organic Mercury from Sea Water by the Plaice, Pleuronectes platessa L., W77-06607 5C

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

Fish Diseases and Parasites in Relation to the Environment, W77-06744 5C

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in Ictalurus punctatus (Channel Catfish), W77-06759 5C

FISH POPULATIONS

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

FISHES

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

FLAME IONIZATION DETECTOR

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

FLAVORS (FISH)

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

FLOCCULATION

Some Factors Affecting Flocc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D

SUBJECT INDEX

FLOCCULATION

Process Technological Background Regarding New Protective Regulations of Water Bodies-Results of Nitrification and Phosphorus Elimination Experiments in Zurich and Bern. III. Filtration by Flocculation for the Elimination of Phosphorus from Communal Waste Water (Verfahrenstechnische Unterlagen im Hinblick auf die neuen Gewässerschutzanforderungen-Ergebnisse der Versuche ueber die Nitrifikation und Phosphorelimination in Zuerich und Bern. III. Flockungsfiltration zur Elimination von Phosphor aus Kommunalem Abwasser), W77-07082 5D

FLOOD CONTROL

Integration of Aquifers in Flood Control Projects, W77-06723 4A

Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A

Flood Management Study, W77-06952 6F

Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C

FLOOD DATA

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

FLOOD FLOW

Causes of the Drying up of Forests in the Flood Plain of the Lower Reaches of the Ural River, (In Russian), W77-06801 4D

FLOOD FORECASTING

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C

FLOOD FRINGE AREA

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

FLOOD PLAIN INSURANCE

Flood Management Study, W77-06952 6F

FLOOD PLAIN MANAGEMENT

Flood Management Study, W77-06952 6F

FLOOD PLAIN ZONING

Flood Management Study, W77-06952 6F

FLOOD PLAINS

Causes of the Drying up of Forests in the Flood Plain of the Lower Reaches of the Ural River, (In Russian), W77-06801 4D

Hydraulics of Sheet Flow in Wetlands, W77-06929 8B

Flood Management Study, W77-06952 6F

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A

FLOOD PROFILES

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A

FLOOD PROTECTION

Integration of Aquifers in Flood Control Projects, W77-06723 4A

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

FLOODING

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L

FLOODS

Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations, W77-06676 4A

Hydrological Evaluation of Changes in Runoff Characteristics, W77-06732 4A

Flood Management Study, W77-06952 6F

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

London's Stormwater Problem, W77-06983 5D

FLOODWAYS

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

FLORIDA

Littoral Drift Estimates Along the Coastline of Florida, W77-06882 2L

Incipient Sediment Motion in Entrances with Shell Beds, W77-06930 2L

Coastal Facility Guidelines: A Methodology for Development with Environmental Case Studies on Marinas and Power Plants, W77-06936 6G

Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

Expansion Comes Quickly to AWT Plant, W77-07009 5D

FLOW

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A

FLOW CONTROL

Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D

FLOW EQUALIZATION

Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D

FLOW RATES

Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D

FLOW SEPARATION

Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D

FLUCTUATIONS

Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A

FLUORIDES

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

FLUOSOLIDS

Fluosolids Incinerator Commissioned at Esher, W77-07018 5E

FLUSHING

Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L

FOAM

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

FOG

Compressed Air for Supercooled Fog Dispersal, W77-06674 3B

FOG DISPERSAL

Compressed Air for Supercooled Fog Dispersal, W77-06674 3B

SUBJECT INDEX

GERMANIUM DIODES

FOOD CHAINS

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes, W77-06695 5C

FOOD HABITS

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

FOOD WEBS

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

FORECASTING

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

Hydraulics of Sheet Flow in Wetlands, W77-06929 8B

FOREST MANAGEMENT

Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian), W77-06745 4C

FORESTS

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

Causes of the Drying up of Forests in the Flood Plain of the Lower Reaches of the Ural River, (In Russian), W77-06801 4D

A Model for the Water Regime of a Deciduous Forest with Special Consideration of the Functional Interrelationships Among Meteorological Factors, Soil Water Content and Evapotranspiration, (In German), W77-06864 2A

FORMALIN

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

FORMIC ACID

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

FORMULAS

Simple Formulae for the Estimation of Wet Bulb Temperature and Precipitable Water, W77-06646 2B

FOSSIL FUELS

Guidelines for the Preparation of Environmental Reports for Fossil-Fueled Steam Electric Generating Stations, W77-06918 6G

FREEZING SOILS

Suprapermafrost Water, W77-06630 2C

FREQUENCY ANALYSIS

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

FRESHWATER

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

FRESHWATER FISH

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H

FRY

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

FUELS

Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D

FUNGI

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C

Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A

FUNGICIDES

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

GAMMA RAY TREATMENT

Treatment of Sewage by Electrons and Gamma-rays, W77-07012 5D

GAS BUBBLE DISEASE

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

Gas Bubble Disease of Salmonids: A Critical Review, W77-06920 5

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

GAS BUBBLE DISEASES

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

GAS CHROMATOGRAPHY

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

GASES

Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D

GASTROPODS

The Fauna of the Polluted River Tees Estuary, W77-06638 5C

GENERAL EQUILIBRIUM ANALYSIS

A Dynamic Multisector Programming Approach to Regional Water Resource Management, W77-06737 6A

GEOGRAPHY

Climatology for Geographers, W77-06659 2B

GEOLOGIC LINEATIONS

Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D

GEORGIA

Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B

Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island. Wassaw Island Erosion Study, Part III, W77-06940 8G

GEOHERMAL BRINES

Mineral Content of Selected Geothermal Waters, W77-06667 3E

GEOHERMAL STUDIES

Mineral Content of Selected Geothermal Waters, W77-06667 3E

GEOHERMAL WATERS

Mineral Content of Selected Geothermal Waters, W77-06667 3E

GERMANIUM DIODES

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

SUBJECT INDEX

GERMANY

GERMANY

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

GHANA

Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling, W77-06893 2L

GLADSTONE (MO)

Contract Services Stretch Sewer Maintenance Budget, W77-06994 8G

GLUSZYCA (POLAND)

Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

GRADATION

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

GRADIENTS (STREAMS)

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

GRANDE RONDE DRAINAGE BASIN (OR)

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G

GRAZING

Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A

GREAT LAKES

The Observed Winter Circulation of Lake Ontario, W77-06655 2H

GROUNDWATER

Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A

Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch), W77-06681 2G

Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C

Hybrid Computer Analysis of a Combined Surface Water-Groundwater System, W77-06729 4B

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F

GROUNDWATER MINING

Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B

GROUNDWATER MOVEMENT

Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B

Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations, W77-06965 2F

Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite, W77-06975 5B

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater, W77-06981 5B

GROUNDWATER RECHARGE

Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow, W77-06905 2F

GROUNDWATER RESOURCES

On Large-Scale Simulation of Groundwater Flow Systems, W77-06713 4B

Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B

GROUTING

Testing and Grouting Leaking Joints, W77-06986 8G

GROWTH RATES

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

UNOX System for Waste Water Treatment, W77-07014 5D

Some Factors Affecting Floc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D

GULF OF ALASKA

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

HABITATS

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

HAIL

Weather Modification in the Soviet Union--1976, W77-06644 3B

On the Status of Hail Suppression, W77-06645 3B

HAIL SUPPRESSION

Weather Modification in the Soviet Union--1976, W77-06644 3B

On the Status of Hail Suppression, W77-06645 3B

HARDNESS (WATER)

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

HARZ MOUNTAINS (FEDERAL REPUBLIC OF GERMANY)

Optimal Operations of Reservoirs in the Harz Mountains, W77-06715 4A

HAWAII

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

HEAT

Energy Conservation and Heat Recovery in Waste Water Treatment Plants, W77-07024 5D

HEAT PUMPS

Energy Conservation and Heat Recovery in Waste Water Treatment Plants, W77-07024 5D

HEAT SINKS

An Annular Flow Ice-Water Model Heat Sink, W77-06889 2C

SUBJECT INDEX

ICE

HEAT TREATMENT

Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D

HEATED WATER

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

HEAVY METALS

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A

The Growth of Young Salmonids (Onchorhynchus Keta): Controlled Ecosystem Pollution Experiment, W77-06618 5A

Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A

Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A

Loch Ewe Bag Experiment, 1974, W77-06627 5A

The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of *Vorticella Convalaria* Var *Similis*, W77-06636 5C

Heavy Metals in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W77-06790 5C

Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E

Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B

Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

HELIX ASPERSA

The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C

HEMATOLOGY

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

HERBICIDES

Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B

HEXAVALENT CHROMIUM

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (*Salmo Gairdneri*), W77-06639 5C

HIGHWAYS

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

HISTOLOGY

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

HISTORIC FLOODS

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

HISTORY

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

HUMIDITY

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

HUNGARY (MARTELY)

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G

HURRICANE AGNES

Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations, W77-06676 4A

HURRICANE AGNES (1972)

Flood Management Study, W77-06952 6F

HYBRID COMPUTERS

Hybrid Computer Analysis of a Combined Surface Water-Groundwater System, W77-06729 4B

HYDRAULIC CONDUCTIVITY

Suprapermafrost Water, W77-06630 2C

HYDRAULIC HEAD

A Device for Measuring Seepage Flux in Lakes and Estuaries, W77-06903 7B

HYDRAULIC SYSTEMS

Pumping Systems: The Simpler, The Better, W77-06856 8C

HYDRO-POWER SYSTEMS

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A

HYDROCRYLE

The Influence of Acrolein and Hydrocryle on the Development Dynamics of Aquatic Bacteria, W77-06690 5C

HYDROGEN PEROXIDE

Control Sewer Corrosion with H2O2, W77-06993 8G

HYDROGEN SULFIDE

Control Sewer Corrosion with H2O2, W77-06993 8G

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

HYDROGEOLOGY

Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite, W77-06975 5B

HYDROLOGIC BUDGET

Water in the Palouse River Basin, Washington, W77-06978 4B

HYDROLOGIC CYCLE

Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

HYDROLOGY

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

Mathematical Models in Hydrology, W77-06708 2A

Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

Hydrological Evaluation of Changes in Runoff Characteristics, W77-06732 4A

HYDROMETRIC NETWORKS

Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A

HYDROPLANTS

Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A

HYPHOMYCETES

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

ICE

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

SUBJECT INDEX

ICE

- An Annular Flow Ice-Water Model Heat Sink,
W77-06889 2C
- Devon Island Ice Cap: Core Stratigraphy and
Paleoclimate,
W77-06890 2C

ICE CAPS

- Devon Island Ice Cap: Core Stratigraphy and
Paleoclimate,
W77-06890 2C

ICE-WATER INTERFACES

- An Annular Flow Ice-Water Model Heat Sink,
W77-06889 2C

ILLINOIS

- Environmental Pollution: Is There Enough
Public Concern to Lead to Action,
W77-06955 6G
- Underflow from Sludge-Irrigated Cropland,
W77-07056 5B

IMPULSE ELECTRIC CHARGES

- Water Decontamination in Northern Regions
by Impulse Electric Charges, (In Russian),
W77-06791 5D

INCINERATION

- Burning Waste Chlorinated Hydrocarbons in a
Cement Kiln,
W77-06946 5E
- Fluosolids Incinerator Commissioned at Esher,
W77-07018 5E

INCINERATORS

- Sludge Incineration at Esher.
W77-07020 5E

INCUBATION

- Egg Incubation and Larval Rearing of Navaga
(Eleginus Navaga Pall.), Polar Cod
(Boreogadus Saida Lepechin) and Arctic
Flounder (Liopsetta Glacialis Pall.) in the
Laboratory,
W77-06792 8I

INDIA

- Area-Depth Relations for Frequency Values of
Rainfall,
W77-06647 2B
- A Study to Forecast the Waves at Digha,
W77-06648 2L

INDIAN RESERVATIONS

- Preliminary Assessment of the Water
Resources of the Tulalip Indian Reservation,
Washington,
W77-06971 4A

INDIANA

- A Study of the Utilization of EREP Data from
the Wabash River Basin,
W77-06670 7B
- Growth and Movement of Fish in the Vicinity
of a Thermal Discharge,
W77-06766 5C

- Monroe Reservoir, Indiana, Part I: Hydrologic
Circulation, Sedimentation, and Water Chemis-
try Part II: Nutrient Relations,
W77-06982 5C

INDICATORS

- Distribution and Indicatory Value of the Sub-
merged Macrophytes in the Flowing Waters of
the Friedberger Au, (In German),
W77-06802 5C

INDUSTRIAL WASTES

- Dispersion of Liquid Waste from a Moving
Barge,
W77-06913 5B

- Activated Sludge Treatment of High Strength
NSSC Mill Effluent,
W77-06945 5D

- Water Quality Management and the Distribu-
tion of Emission Rights by Sealed Tender Mar-
kets,
W77-06976 5E

- Municipal Waste Water Treatment as an Indus-
trial Operation,
W77-07025 5D

- Plastic Spheres for Waste Water Treatment.
W77-07028 5D

- Hygienic Effectiveness of Measures for Decon-
taminating Effluents at Petrochemical Plants,
(In Russian),
W77-07069 5D

- Composting of Sewage Sludge and Solid Waste
Matter,
W77-07084 5D

INERTIAL OSCILLATIONS

- An Analysis of Inertial Oscillations Observed
Near Oregon Coast,
W77-06892 2L

INFILTRATION

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

- Oregon's Long Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

INFILTRATION RATES

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

INFLOW

- Hydrochemistry of the Lake Magadi Basin,
Kenya,
W77-06967 2K

INFORMATION EXCHANGE

- Design Study of Environmental and Human
Cultural Information System Needs in Urban
Water Resource Development,
W77-06634 6B

- Environmental Pollution: Is There Enough
Public Concern to Lead to Action,
W77-06955 6G

INFRASTRUCTURE

- The Growth Shapers: The Land Use Impacts of
Infrastructure Investments.
W77-06601 6D

INJECTION

- Subsurface Injection-How Much Does It Cost,
W77-07011 5E

INJECTION WELLS

- Waste Injection into Stratified Ground Water
Bodies,
W77-06855 5B

INLETS (WATERWAYS)

- The Influence of Wind on the Surface Layer of
a Stratified Inlet: Part I. Observations,
W77-06894 2L

- The Influence of Wind on the Surface Layer of
a Stratified Inlet: Part II. Analysis,
W77-06895 2L

- Characteristics of Water Flow at the North End
of the Wassaw Barrier Island Complex. Was-
saw Island Erosion Study, Part II,
W77-06939 2J

INORGANIC COMPOUNDS

- Water Quality Simulation of Tahoe-Truckee
System, Nevada-California-Volume I,
W77-07075 5B

INPUT-OUTPUT ANALYSIS

- The Generation of Residual Flows in Norway:
An Input-Output Approach,
W77-06698 5G

- An Input-Output Analysis of Environmental
Preservation,
W77-06706 6G

- Economic Analysis of Alternative Groundwater
Withdrawal Rates in Conjunction with Surface
Water Irrigation,
W77-06740 4B

INSECTICIDES

- Field Tests of Isobornyl Thiocyanacetate
(Thanite) for Live Collection of Fishes,
W77-06747 5C

INSECTS

- The Mining Fauna in Four Macrophyte Species
in Mikolajskie Lake,
W77-06688 5C

INSPECTION

- Cincinnati's Preventive Maintenance Sewer
Program.
W77-06989 5G

- Preventive Sewer Maintenance Helps Preserve
Historic Annapolis.
W77-06990 8G

INSTRUMENTATION

- Coastal Meteorological Networks to Determine
Effects of Nuclear Plant Cooling Systems,
W77-06643 2B

- A Study of the Utilization of EREP Data from
the Wabash River Basin,
W77-06670 7B

- A Device for Measuring Seepage Flux in Lakes
and Estuaries,
W77-06903 7B

SUBJECT INDEX

KINETICS

- Optic Device for Observations of Small Organisms Under Water, (In Russian), W77-06926 7B
- A Universal Calibration Equation for Price Meters and Similar Instruments, W77-06943 7B
- Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B
- New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G
- INTERCEPTOR SEWERS**
Sewerage for a Rural Resort Area, W77-06987 5D
- INTERMEDIATE REGIONAL FLOOD**
Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona, W77-06954 4A
- INTERMUNICIPAL TAX SHARING**
Flood Management Study, W77-06952 6F
- INTERNAL TIDES**
Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B
- INTERNAL WAVES**
An Analysis of Inertial Oscillations Observed Near Oregon Coast, W77-06892 2L
- INVERTEBRATES**
The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C
- Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C
- Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C
- Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G
- The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G
- INVESTIGATIONS**
Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B
- INVESTMENT**
A Sector Model for Regional and National Water Resources Planning, W77-06731 6A
- ION EXCHANGE**
Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A
- IONIZATION**
Treatment of Sewage by Electrons and Gammam, W77-07012 5D
- IRON BACTERIA**
New Design Gives Denver District Iron-Free Well, W77-06868 8A
- IRRADIATION**
Electron-Beam Irradiation of Waste Products--e.g., For Sterilization of Sewage Sludge and Waste Industrial Products, W77-06997 5D
- Treatment of Sewage by Electrons and Gammam, W77-07012 5D
- IRREVERSIBLE EFFECTS**
Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G
- IRRIGATION**
Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G
- Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G
- Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B
- Water in the Palouse River Basin, Washington, W77-06978 4B
- Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B
- Underflow from Sludge-Irrigated Cropland, W77-07056 5B
- IRRIGATION EFFECTS**
The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F
- IRRIGATION PRACTICES**
Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C
- IRRIGATION SYSTEMS**
The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F
- ISOBORNYL THIOCYANOACETATE**
Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C
- ITALY (PADUA)**
The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C
- JAMAICA BAY (NY)**
Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A
- JAPAN (MIYAKE-JIMA)**
Notes on the Nesting Success and Fecundity of the Anemonefish Amphiprion Clarkii at Miyake-Jima, Japan, W77-06763 5C
- JET PUMPS**
It's All on the Nameplate: Everything You Always Wanted to Know About Jet Pumps, W77-06854 8C
- JETS**
Method of Treating Waste Water with Jet Nozzles, W77-07090 5D
- JUVENILE FISH**
The Growth of Young Salmonids (Onchorhynchus Keta): Controlled Ecosystem Pollution Experiment, W77-06618 5A
- KANSAS**
Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F
- Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F
- KAOLINITE**
Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G
- KATHAROBIC WATERS**
Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C
- KENTUCKY**
Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G
- KENYA (RIFT VALLEY)**
Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K
- KEYSTONE RESERVOIR (OK)**
A New Reservoir and Recreational Behavior, W77-06956 6B
- KINETICS**
The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D
- Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds, W77-07054 5B

SUBJECT INDEX

KINETICS

KODIAK ISLAND (ALAS)

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

KOOTENAI RIVER (MONT)

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

KOTZEBUE SOUND (ALAS)

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

LABORATORY TESTS

Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C

A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (*Salmo Gairdneri*), W77-06639 5C

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

Some Effects on Integral Photosynthesis of Artificial Circulation of Phytoplankton Through Light Gradients, W77-06696 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (*Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature*), W77-06779 5C

Laboratory Studies on the Effect of Metals on Oxygen Uptake by Sewage Sludge in Brackish Water, W77-06788 5C

Egg Incubation and Larval Rearing of Navaga (*Eleginus Navaga* Pall.), Polar Cod (*Boreogadus Saida* Lepechin) and Arctic Flounder (*Liopsetta Glacialis* Pall.) in the Laboratory, W77-06792 8I

LAKE BIKCZE (POLAND)

Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character, W77-06685 5C

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle, W77-06692 5C

LAKE CARL BLACKWELL (OKLA)

Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A

LAKE CIRCULATION

The Observed Winter Circulation of Lake Ontario, W77-06655 2H

LAKE GEORGE (NEW YORK)

Nutrient Removal and Sludge Disposal Within Septic Systems-Phase III, W77-06686 5D

LAKE GEORGE (NY)

Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G

A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C

LAKE HURON

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

LAKE IN THE CLOUDS (MINN)

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

LAKE MAGADI BASIN (KENYA)

Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K

LAKE MICHIGAN

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B

Lake Currents and Temperatures Near the Western Shore of Lake Michigan, W77-06687 2H

LAKE MONROE (IND)

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

LAKE ONTARIO

The Observed Winter Circulation of Lake Ontario, W77-06655 2H

Lake Ontario Atlas: Surface Waves, W77-06884 2H

LAKE PIASECZNO (POLAND)

Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character, W77-06685 5C

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle, W77-06692 5C

LAKE RESTORATION

Lake Restoration by Bottom Water Siphoning (In German), W77-06689 5G

LAKE SEDIMENTS

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

LAKE ST. CLAIR

Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H

LAKE TJEUKEMEER (NETHERLANDS)

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes, W77-06695 5C

LAKE VECHTEN (NETHERLANDS)

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes, W77-06695 5C

LAKES

Mixing in Upper Layer of a Lake During Heating Cycle, W77-06649 2H

Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle, W77-06692 5C

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes, W77-06695 5C

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H

Lake Ontario Atlas: Surface Waves, W77-06884 2H

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H

Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

LAMINATED SEDIMENTS

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

LAND DEVELOPMENT

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

SUBJECT INDEX

LOUISIANA

LAND FORMING

Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F

LAND MANAGEMENT

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

Diminution Ratios for Planning Construction-Area Sediment Controls, W77-06980 4D

LAND RESOURCES

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

LAND USE

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development, W77-06634 6B

Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A

A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B

Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

Flood Management Study, W77-06952 6F

LANDFILLS

Study of Leachate at Landfill Site: 1975, Volume 1, W77-06851 5B

What's New in Landfill Liners, W77-07051 5G

LANDSAT

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A

A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B

LARVAE

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

LARVAL GROWTH STAGE

Egg Incubation and Larval Rearing of Navaga (Eleginus Navaga Pall.), Polar Cod (Boreogadus Saida Lepechin) and Arctic Flounder (Liopsetta Glacialis Pall.) in the Laboratory, W77-06792 8I

LAURENTIAN CHANNEL

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

LEACHATE MIGRATION

Study of Leachate at Landfill Sites 1975, Volume 1, W77-06851 5B

LEACHATES

Characterization of Soluble Organic Matter in Leachate, W77-07039 5A

LEAD

The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, Helix aspersa Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of Vorticella Convalaria Var Similis, W77-06636 5C

Long-Term Lead Accumulation in Abalone (Haliotis Spp.) Fed on Lead-Treated Brown Algae (Egregia Laevigata), W77-06776 5C

Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C

LEAF MESOPHYLL

Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I

LEAKAGE

Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B

Testing and Grouting Leaking Joints, W77-06986 8G

LEAKY AQUIFERS

Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B

LEGISLATION

Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E

LEPOMIS SSP

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

LETHAL LIMIT

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

LIFE SPAN

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

LIGHT

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D

LIGHT PENETRATION

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

Some Effects on Integral Photosynthesis of Artificial Circulation of Phytoplankton Through Light Gradients, W77-06696 5C

LINEAR ALKYLATE SULFONATES

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

LINEAR PROGRAMMING

Integration of Aquifers in Flood Control Projects, W77-06723 4A

LININGS

The Fabric-Lined Purification Basin, W77-07035 5D

What's New in Landfill Liners, W77-07051 5G

LIQUID WASTES

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D

Underflow from Sludge-Irrigated Cropland, W77-07056 5B

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

LITERATURE REVIEWS

Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry, W77-06951 5D

LITTORAL

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

LITTORAL DRIFT

Littoral Drift Estimates Along the Coastline of Florida, W77-06882 2L

LOCK EWE (SCOTLAND)

Loch Ewe Bag Experiment, 1974, W77-06627 5A

LONG ISLAND SOUND

Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B

LONG-TERM PLANNING

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A

A Sector Model for Regional and National Water Resources Planning, W77-06731 6A

LOUISIANA

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

SUBJECT INDEX

LOWER SNAKE RIVER

LOWER SNAKE RIVER

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1963-1969, W77-06925 5C

LURGI PROCESS

Energy Development: The Environmental Tradeoffs, Volume 4: The Background Papers, W77-06957 6G

LYSIMETERS

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

MACROBRACHIUM ROSENBERGII

Algal Supplement Enhancement of Static and Recirculating System, W77-06933 5C

MACROPHYTES

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

MACROPHYTES (SUBMERGED)

Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C

MADDEN LAKE (PANAMA CANAL ZONE)

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

MAINE

The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes, W77-06741 5C

Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D

MAINTENANCE

Cincinnati's Preventive Maintenance Sewer Program, W77-06989 5G

Preventive Sewer Maintenance Helps Preserve Historic Annapolis, W77-06990 8G

Contract Services Stretch Sewer Maintenance Budget, W77-06994 8G

MALACHITE GREEN

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

MALHEUR RIVER DRAINAGE BASIN (OR)

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

MAMMALS

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

MANAGEMENT

Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development, W77-06634 6B

La Science des Systemes dans la Planification des Ressources en Eau, W77-06736 6A

Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project, W77-06739 6B

Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

Coastal Zone Management, Annotated Bibliography, W77-06937 2L

MAPPING

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A

River Basin Snow Mapping at the National Environmental Satellite Service, W77-06915 2C

MARINE ANIMALS

Evaluation of Potential Indicators of Sublethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A

MARINE BACTERIA

Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

MARINE BIOLOGY

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

MARINE ECOSYSTEMS

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

MARINE ENVIRONMENTS

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

MARINE FUNGI

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C

MARINE MICROORGANISMS

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

MARKOV PROCESSES

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

MARYLAND

An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

Preventive Sewer Maintenance Helps Preserve Historic Annapolis, W77-06990 8G

MASSACHUSETTS

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G

MASSACHUSETTS BAY

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

MATHEMATICAL MODELS

An Approximating Polynomial for the Computation of Saturation Vapor Pressure, W77-06652 2B

The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.: Theory and Quantitative Models, W77-06675 2B

A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C

Mathematical Models in Hydrology, W77-06708 2A

Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

A Model for the Water Regime of a Deciduous Forest with Special Consideration of the Functional Interrelationships Among Meteorological

SUBJECT INDEX

METHODOLOGY

- Factors, Soil Water Content and Evapotranspiration, (In German), W77-06864 2A
- A Test Particle Dispersion Study in Massachusetts Bay. W77-06880 2L
- Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H
- Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations, W77-06965 2F
- MATHEMATICAL SMOOTHING**
Smoothing Data with Cubic Splines, W77-06831 7C
- MATHEMATICAL STUDIES**
Smoothing Data with Cubic Splines, W77-06831 7C
- MEASUREMENT**
Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A
- A Universal Calibration Equation for Price Meters and Similar Instruments, W77-06943 7B
- Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B
- MEDITERRANEAN COAST (ISRAEL)**
Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-06782 5C
- MEDITERRANEAN SEA**
Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L
- Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L
- MEDWAY ESTUARY (ENG)**
Heavy Metals in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent, W77-06790 5C
- MEMBRANE PROCESSES**
LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C
- MENHADEN**
Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G
- MERCURY**
The Accumulation of Organic Mercury from Sea Water by the Plaice, *Pleuronectes platessa* L., W77-06607 5C
- Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A
- The Toxic Effects of Selected Heavy Metals on Unadapted Populations of *Vorticella Convalaria* Var *Similis*, W77-06636 5C
- A Preliminary Survey of Mercury in Fish from Bombay and Thana Environment, W77-06785 5C
- METABOLISM**
Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C
- Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C
- Gas Bubble Disease of Salmonids: A Critical Review, W77-06920 5
- METAL FINISHING INDUSTRY**
Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario, W77-06950 5D
- METALS**
The Accumulation of Organic Mercury from Sea Water by the Plaice, *Pleuronectes platessa* L., W77-06607 5C
- The Toxic Effects of Selected Heavy Metals on Unadapted Populations of *Vorticella Convalaria* Var *Similis*, W77-06636 5C
- Partial Extraction of Metals from Aquatic Sediments, W77-06781 5A
- Laboratory Studies on the Effect of Metals on Oxygen Uptake by Sewage Sludge in Brackish Water, W77-06788 5C
- Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario, W77-06950 5D
- METEOROLOGICAL DATA**
Simple Formulae for the Estimation of Wet Bulb Temperature and Precipitable Water, W77-06646 2B
- Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G
- A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L
- METHANE**
Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C
- Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. 1. Dissolved Gases, W77-06900 5B
- Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D
- METHANE BACTERIA**
Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C
- METHANE CONTENT**
Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. 1. Dissolved Gases, W77-06900 5B
- METHANE FORMATION**
Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C
- METHANE OXIDIZING BACTERIA**
Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C
- METHANE PRODUCERS**
Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C
- METHODOLOGY**
Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C
- A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C
- An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C
- A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A
- Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A
- Loch Ewe Bag Experiment, 1974, W77-06627 5A
- An Offshore Biomonitoring System for Chlorinated Hydrocarbons, W77-06641 5A
- Climatology for Geographers, W77-06659 2B
- Presenting Trends in Lake Eutrophication, W77-06693 5C
- Mathematical Models in Hydrology, W77-06708 2A
- Simplified Methods of Computing the Quantity of Urban Runoff, W77-07072 5B

SUBJECT INDEX

METHODOLOGY

METHOXYCHLOR

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

MIAMI-DADE (FLORIDA) WATER AND SEWER AUTHORITY

Expansion Comes Quickly to AWT Plant, W77-07009 5D

MICHIGAN

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B

MICRO-ZOOPLANKTON

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

MICROBIAL DEGRADATION

A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C

Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C

MICROORGANISMS

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

Escherichia Coli as a Sanitary-Indicator Microorganism, (In Russian), W77-07067 5A

MICROWAVES

Waste Water System Uses Microwaves, W77-07019 5D

MIGRATORY BIRDS

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G

MIKOLAJSKIE LAKE (POLAND)

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

MILLET

Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I

MINE WASTES

Experience in Treating Waste Waters from the Donetsk Mines, (In Russian), W77-07068 5D

MINERAL CONTENT

Mineral Content of Selected Geothermal Waters, W77-06667 3E

MINERAL EXTRACTION

Mineral Content of Selected Geothermal Waters, W77-06667 3E

MINERAL QUALITY

Mineral Content of Selected Geothermal Waters, W77-06667 3E

MINERAL WATER

Mineral Content of Selected Geothermal Waters, W77-06667 3E

MINERALIZED GROUNDWATER

Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C

MINERALOGY

Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C

MINNESOTA

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

A Device for Measuring Seepage Flux in Lakes and Estuaries, W77-06903 7B

Sewerage for a Rural Resort Area, W77-06987 5D

MISSISSIPPI DELTA

Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

MISSISSIPPI RIVER

Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

MISSISSIPPI SOUND

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

MISSOURI RIVER BASIN

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

MITOCHONDRIA

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in Ictalurus punctatus (Channel Catfish), W77-06759 5C

MIXING

Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G

Mixing in Upper Layer of a Lake During Heating Cycle, W77-06649 2H

MODE OF ACTION

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

MODEL STUDIES

The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.; Theory and Quantitative Models, W77-06675 2B

Investigation of the Effects of Nonhomogeneous (or Nonstationary) Behavior on the Spectra of Atmospheric Turbulence, W77-06678 2B

Adjustment Costs and Optimal Waste Treatment, W77-06699 5D

Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G

Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G

Optimal Investment in Pollution Control Capital in a Neoclassical Growth Context, W77-06705 6G

Observations of Wind-Generated Waves on Variable Current, W77-06896 2L

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations, W77-06965 2F

Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater, W77-06981 5B

The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

Introduction to Urban Storm Water Runoff Models, W77-07071 5B

The WRE Storm Model, W77-07073 5B

Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

A Nonlinear Multilevel Transportation Model for Water Resource-Water Quality Management, W77-07096 5B

On-Line Adaptive Control for Combined Sewer Systems, W77-07100 5D

MODIFIED UNIVERSAL SOIL LOSS EQUATION

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

SUBJECT INDEX

NEW JERSEY

MOISTURE CONTENT

- Some Significant Regularities in Plant
Hydroadaptation, (In Russian),
W77-06774 3B
- A Method of Evaluating a Field Water Capacity
Using PF-3, (In French),
W77-06844 2G

MOLDAVIAN SSR

- Antierosion Role of Forest Plantings in the
Steppe Zone of the Moldavian SSR, (In Russian),
W77-06745 4C

MOLLUSKS

- The Uptake of Lead, Zinc, Cadmium, and
Copper by the Pulmonate Mollusc, *Helix aspersa*
Muller, and its Relevance to the Monitoring
of Heavy Metal Contamination of the Environment,
W77-06629 5C
- Occurrence and Growth of *Dreissena*
Polymorpha Pall. in Lakes Included in a Cooling
System, (In Polish),
W77-06754 5C

MONITORING

- A Biological Monitoring System Employing
Rheotaxis of Fish,
W77-06609 5C
- An Electronic System to Monitor the Effects of
Changes in Water Quality on Fish Opercular
Rhythms,
W77-06610 5C
- An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A
- Monitoring the Marine Environment Through
Sedimentation,
W77-06651 2L
- Monitoring Groundwater Quality: Illustrative
Examples,
W77-06673 5A
- Study of Leachate at Landfill Sites 1975,
Volume 1,
W77-06851 5B
- NASA Develops Water Monitoring System,
W77-06912 5A
- Algal Supplement Enhancement of Static and
Recirculating System,
W77-06933 5C
- Comprehensive Monitoring of Meteorology,
Hydraulics, and Thermal Regime of the San
Diego Aqueduct, California,
W77-06973 2D
- The Chemical Characteristics of the City of
Winnipeg Waste Water,
W77-07047 5A

MONTANA

- A Preliminary Evaluation of the Effects of Gas
Bubble Disease on Fish Populations in the
Kootenai River Below Libby Dam,
W77-06919 5C

MONTE CARLO METHOD

- Optimal Design and Operation of Reservoir
Systems,
W77-06721 4A

MONTEREY BAY (CALIF)

- Effects of Engineering Activities on the Ecology
of Pismo Clams,
W77-06886 5C
- In Situ Acoustic Measurements of Microbubbles
at Sea,
W77-06916 2L

MORTALITY

- Effects of Copper on Phytoplankton Standing
Crop and Productivity: Controlled Ecosystem
Pollution Experiment,
W77-06624 5A

- Field Tests of Isobornyl Thiocyanacetate
(Thanite) for Live Collection of Fishes,
W77-06747 5C

- Toxicity of Rotenone to Fish in Standardized
Laboratory Tests,
W77-06748 5C

- Environmental Factors Affecting Survival and
Growth of *Vibrio Parahaemolyticus*. A Review,
W77-06765 5C

- Effect of Atmospheric Gas Supersaturation
Caused by Dams on Salmon and Steelhead
Trout of the Snake and Columbia Rivers (A
Review of the Problem and the Progress
Toward a Solution, 1974),
W77-06927 5C

MORTANDAD CANYON (NM)

- Chemical Quality of Effluents and Their Influence
on Water Quality in a Shallow Aquifer,
W77-06658 5B

MOUNTAIN WHITEFISH

- A Preliminary Evaluation of the Effects of Gas
Bubble Disease on Fish Populations in the
Kootenai River Below Libby Dam,
W77-06919 5C

MULTI-LEVEL SECTOR MODEL

- A Sector Model for Regional and National
Water Resources Planning,
W77-06731 6A

MULTIPLE PURPOSE

- Methods for Control of the Regimes for Water
Resources Systems,
W77-06717 4A

MULTIPLE-PURPOSE RESERVOIRS

- The Conjunctive Use of a Multi-Reservoir
System and a Dual-Purpose Desalting Plant,
W77-06714 4B

MULTIPLE WELLS

- Hydraulics and Economics of Well Field
Layout,
W77-06863 8B

MULTISPECTRAL SCANNING

- The Use of Remote Sensing to Detect How
Wind Influences Planktonic Blue-Green Algal
Distribution,
W77-06697 5C

MUNICIPAL WASTE WATER

- Waste Water Reuse Practice in the United
States,
W77-07087 5D

MUNICIPAL WASTES

- The Plight and Promise of On-Site Waste Water
Treatment,
W77-07010 5D

- Municipal Waste Water Treatment as an Industrial
Operation,
W77-07025 5D

- Upgrading Biological Sewage Treatment Plants
Today,
W77-07062 5D

- The Current Role of Wastewater Disinfection,
W77-07064 5D

- Composting of Sewage Sludge and Solid Waste
Matter,
W77-07084 5D

- Effect of Water Work's Sludge on Waste
Water Treatment,
W77-07085 5D

MUSSELS

- An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A

- A Pilot Study on the Design of a Petroleum
Hydrocarbon Baseline Investigation for
Northern Puget Sound and Strait of Juan de
Fuca,
W77-06875 5C

MYTILUS CALIFORNIANUS

- An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A

NATIONAL ENVIRONMENTAL POLICY ACT

- Environmental Impact Statements in Water
Resources Planning and Decision Making,
W77-06738 6E

NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS)

- River Basin Snow Mapping at the National
Environmental Satellite Service,
W77-06915 2C

NATURAL RESOURCES

- Regulating Activities with Catastrophic
Environmental Effects,
W77-06703 6G

NEBIT-DAG (TURKMAN SSR)

- Irrigation of the Nebit-Dag Plantings by
Mineralized Ground Water, (In Russian),
W77-06691 3C

NEMATODES

- The Fauna of the Polluted River Tees Estuary,
W77-06638 5C

NETS

- Zooplankton Sampling Variability: Controlled
Ecosystem Pollution Experiment,
W77-06615 5A

NETWORK DESIGN

- Surface Water Network Design by Regression
Analysis Simulation,
W77-06963 2E

NETWORKS

- Coastal Meteorological Networks to Determine
Effects of Nuclear Plant Cooling Systems,
W77-06643 2B

- Use of a Parametric Model as a Tool for
Hydrometric Network Planning,
W77-06710 2A

NEW JERSEY

- Impact of Oil Spillage from World War II
Tanker Sinkings,
W77-06877 5C

SUBJECT INDEX

NEW JERSEY

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River.
W77-06953 4A

NEW MEXICO

Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer.
W77-06658 5B

Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico.
W77-06974 5B

NEW YORK

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment.
W77-06660 5A

Monitoring Groundwater Quality: Illustrative Examples.
W77-06673 5A

Means for Protecting the Drinking Water Quality of Lake George, New York.
W77-06682 5G

Nutrient Removal and Sludge Disposal Within Septic Systems-Phase III.
W77-06686 5D

Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae.
W77-06783 5C

Study of Leachate at Landfill Sites 1975, Volume 1.
W77-06851 5B

NEW YORK BIGHT

A Self-Contained Facility for Analyzing Near-Bottom Flow and Associated Sediment Transport.
W77-06874 2L

The New York Bight Project - 1975; Stony Brook, Long Island, New York.
W77-06876 5G

NILE CONE

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal.
W77-06650 2L

NILE RIVER

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal.
W77-06650 2L

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast.
W77-06907 2L

NITRATE LEACHING

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds.
W77-06909 5B

NITRATES

USGS Scientists Bring California Water Supply into Compliance with Federal Regulations.
W77-06853 5G

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary.
W77-06910 5B

NITRIFICATION

UNOX System for Waste Water Treatment.
W77-07014 5D

NITROGEN

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater.
W77-06923 5C

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka).
W77-06924 5C

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969.
W77-06925 5C

Apparatus and Process for Removing Ammonia Nitrogen from Waste Water.
W77-07008 5D

NITROGEN COMPOUNDS

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System.
W77-06743 5C

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds.
W77-06909 5B

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields.
W77-06914 5B

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures.
W77-07079 5D

NITROGEN CONTENT

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds.
W77-06909 5B

NITROGEN SOLUBILITIES

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater.
W77-06923 5C

NITROGEN SUPERSATURATION

Gas Bubble Disease of Salmonids: A Critical Review.
W77-06920 5

NOAA-4

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data.
W77-06887 2B

NON-STRUCTURAL ALTERNATIVES

Flood Management Study.
W77-06952 6F

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River.
W77-06953 4A

NONLINEAR PROGRAMMING

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems.
W77-06730 4A

NORTH ATLANTIC

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic.
W77-06911 5B

NORTH CAROLINA

Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina.
W77-06654 2L

Computer Mapping of Landsat Data for Environmental Applications.
W77-06666 5A

Impact of Oil Spillage from World War II Tanker Sinkings.
W77-06877 5C

A Device for Measuring Seepage Flux in Lakes and Estuaries.
W77-06903 7B

NORTH SEA

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3).
W77-06668 5B

NORTH SLOPE (ALAS)

Sludge Dewatering on Alaska's North Slope.
W77-07030 5D

NORTON BAY (ALAS)

Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska.
W77-06822 6G

NORTON SOUND (ALAS)

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound.
W77-06848 6G

NORWAY

The Generation of Residual Flows in Norway: An Input-Output Approach.
W77-06698 5G

NOVA SCOTIA

A Device for Measuring Seepage Flux in Lakes and Estuaries.
W77-06903 7B

NOXFISH

Toxicity of Rotenone to Fish in Standardized Laboratory Tests.
W77-06748 5C

NUCLEAR POWERPLANT EFFECTS

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems.
W77-06643 2B

NUCLEAR POWERPLANTS

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems.
W77-06643 2B

NUTRIENT REMOVAL

Nutrient Removal and Sludge Disposal Within Septic Systems-Phase III.
W77-06686 5D

Lake Restoration by Bottom Water Siphoning (In German).
W77-06689 5G

Nutrient Removal by Water Hyacinths.
W77-07036 5G

NUTRIENT REQUIREMENTS

The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes.
W77-06741 5C

SUBJECT INDEX

OPTIMIZATION

NUTRIENTS

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D

OCEAN CURRENTS

An Analysis of Inertial Oscillations Observed Near Oregon Coast, W77-06892 2L

OCEAN DUMPING

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

OCEAN WAVES

A Study to Forecast the Waves at Digha, W77-06648 2L

Continental Shelf Waves and Alongshore Variations in Bottom Topography and Coastline, W77-06891 2L

OCEANOGRAPHIC DATA

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

OCEANS

Monitoring the Marine Environment Through Sedimentation, W77-06651 2L

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

In Situ Acoustic Measurements of Microbubbles at Sea, W77-06916 2L

ODOR

Control Sewer Corrosion with H2O2, W77-06993 8G

OHIO

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

Cincinnati's Preventive Maintenance Sewer Program, W77-06989 5G

Agricultural Disposal of Aerobic Wastewater Sludges in an Urban County, W77-07057 5D

Conditioning and Land Application of Aerobically Digested Sludge, W77-07058 5D

OIL POLLUTION

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic, W77-06911 5B

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

OIL SHALE

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

OIL SPILLS

Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G

Impact of Oil Spillage from World War II Tanker Sinkings, W77-06877 5C

OIL TANKERS

Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G

OIL WASTES

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

OKLAHOMA

Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A

A New Reservoir and Recreational Behavior, W77-06956 6B

Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C

OLIGOCHAETA

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish), W77-06750 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of

Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C

OLIGOCHAETES

The Mining Fauna in Four Macrophyte Species in Mikolajskie Lake, W77-06688 5C

ON-SITE DATA COLLECTIONS

Loch Ewe Bag Experiment, 1974, W77-06627 5A

ON-SITE INVESTIGATIONS

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L

In Situ Acoustic Measurements of Microbubbles at Sea, W77-06916 2L

Optic Device for Observations of Small Organisms Under Water, (In Russian), W77-06926 7B

ON-SITE WASTE WATER TREATMENT

The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D

New Visibility for On-Site Waste Treatment Systems, W77-07013 5D

OPEN CHANNELS

Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A

OPEN SPACES PRESERVATION

Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

OPERATION AND MAINTENANCE

The Operations Section of Lincoln Sewage Division, W77-07023 5D

Municipal Waste Water Treatment as an Industrial Operation, W77-07025 5D

OPERATIONS RESEARCH

Mathematical Models in Hydrology, W77-06708 2A

OPERCULAR RHYTHMS (FISH)

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

OPTIC DEVICE

Optic Device for Observations of Small Organisms Under Water, (In Russian), W77-06926 7B

OPTIMIZATION

Adjustment Costs and Optimal Waste Treatment, W77-06699 5D

SUBJECT INDEX

OPTIMIZATION

Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G

Mathematical Models in Hydrology, W77-06708 2A

On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A

Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A

The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A

The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

A Dynamic Multisector Programming Approach to Regional Water Resource Management, W77-06737 6A

OPTIMUM DEVELOPMENT PLANS

Optimal Investment in Pollution Control Capital in a Neoclassical Growth Context, W77-06705 6G

General Description of the Vistula River Project and Basic Planning Data, W77-06733 4A

OREGON

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

An Analysis of Inertial Oscillations Observed Near Oregon Coast, W77-06892 2L

OREGON INLET (NC)

Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina, W77-06654 2L

ORGANIC COMPOUNDS

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

Hydrocarbon Products Manufacture--By Carbonisation of Coal, Scrap Rubber or Plastic or Domestic Sewage Under Reduced Pressure, W77-07000 5D

ORGANIC MATTER

The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F

Characterization of Soluble Organic Matter in Leachate, W77-07039 5A

Advanced Waste Treatment Seminar, Session III, Removal of Solids and Organics, Held at San Francisco, on October 28-29, 1970, W77-07074 5D

ORGANIC WASTES

Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico, W77-06632 5B

ORGANOLEPTIC PROPERTIES

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

OUT-OF-KILTER ALGORITHMS

The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

OUTER CONTINENTAL

Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G

OUTER CONTINENTAL SHELF

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

An Aerial Census of Spotted Seals, *Phoca vitulina* Larga, W77-06800 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped-Fish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus *Puffinus*) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer, W77-06814 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G

Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G

SUBJECT INDEX

PALOUSE RIVER BASIN (WASH)

Avian Community Ecology of the Akulik - In-
glutalik River Delta, Norton Bay, Alaska,
W77-06822 6G

A Comparative Sea-Cliff Bird Inventory of the
Cape Thompson Vicinity, Alaska,
W77-06823 6G

Characterization of Coastal Habitat for Migra-
tory Birds: Northern Bering Sea,
W77-06824 6G

Environmental Assessment of the Alaskan
Continental Shelf. Principal Investigators' Re-
ports July-September 1976. Volume 2: Fish,
Plankton, Benthos, Littoral.
W77-06825 6G

The Distribution, Abundance, Diversity and
Productivity of Benthic Organisms in the Ber-
ing Sea,
W77-06826 6G

Spawning Herring Surveys in the Bering Sea
and Finfish Resource Surveys in Norton Sound
and Kotzebue Sound,
W77-06828 6G

Pelagic and Demersal Fish Assessment in the
Lower Cook Inlet Estuary System,
W77-06829 6G

Razor Clam (*Siliqua Patula*, Dixon) Distribution
and Population Assessment Study,
W77-06830 6G

Resources of Non-Salmonid Pelagic Fish of the
Eastern Bering Sea and the Gulf of Alaska,
W77-06832 6G

Baseline/Reconnaissance Characterization, Lit-
toral Biota, Gulf of Alaska and Bering Sea,
W77-06833 6G

Plankton of the Gulf of Alaska - Ichthyoplank-
ton,
W77-06834 6G

Initial Zooplankton Investigations in Lower
Cook Inlet,
W77-06835 6G

Phytoplankton and Primary Productivity in the
Northeast Gulf of Alaska,
W77-06836 6G

Baseline Studies of Fish and Shellfish
Resources of Norton Sound and the Southeast-
ern Chukchi Sea,
W77-06839 6G

Beaufort Sea Estuarine Fishery Study,
W77-06840 6G

The Distribution, Abundance, Diversity, and
Productivity of Benthic Organisms in the Gulf
of Alaska,
W77-06841 6G

Food and Feeding Relationships in the Benthic
and Demersal Fishes of the Gulf of Alaska and
Bering Sea,
W77-06842 6G

Ichthyoplankton of the Eastern Bering Sea,
W77-06845 6G

Assessment of Pelagic and Nearshore Fish in
Three Bays on Southeast Kodiak Island,
W77-06846 6G

Demersal Fish and Shellfish Assessment in
Selected Estuary Systems of Kodiak Island,
W77-06847 6G

Technical Trawl Survey of the Benthic Epifauna
of the Chukchi Sea and Norton Sound.
W77-06848 6G

The Distribution, Abundance and Diversity of
the Epifaunal Benthic Organisms in Two
(Alitak and Ugak) Bays of Kodiak Island,
Alaska,
W77-06849 6G

A Comprehensive Plan for the Global In-
vestigation of Pollution in the Marine Environ-
ment and Baseline Study Guidelines.
W77-06850 5A

Program Development Plan. Environmental As-
sessment of the Alaskan Continental Shelf,
W77-06878 6G

State Information Needs Related to Onshore
and Nearshore Effects of OCS Petroleum
Development,
W77-06934 6G

OVERFLOW

Chicago Drives Large Bores to Control Com-
bined Sewage Flow.
W77-06988 8E

Single P/C Unit Removal of Nutrients from
Combined Sewer Overflows,
W77-07031 5D

Treatment of Combined Sewer Overflows Via
Thin Film Chemistry,
W77-07034 5D

OWYHEE DRAINAGE BASIN (OR)

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

OXIDATION

Oxidation and Ozonation Chamber,
W77-06999 5D

Waste Treatment Apparatus,
W77-07005 5D

Process for the Treatment of Waste Water by
Heterogeneous Photosensitized Oxidation,
W77-07006 5D

Method of Applying Ozone and Sonic Energy
to Sterilize and Oxidize Waste Water,
W77-07007 5D

Waste Treatment Process,
W77-07091 5D

Ozone Oxidation of Waste Water,
W77-07094 5D

OXIDATION LAGOONS

Stabilisation Lagoons Including Experience in
Brazil. Part I,
W77-07063 5D

OXYGEN

The Solubility of Nitrogen, Oxygen and Argon
in Water and Seawater,
W77-06923 5C

The Effect of High Purity Oxygen on the Ac-
tivated Sludge Process,
W77-07043 5D

OXYGEN DEMAND

The Electrolytic Respirometer-II. Use in Water
Pollution Control Plant Laboratories,
W77-07081 5D

OXYGEN MINIMUM LAYER

Effects of Pressure, Temperature and Oxygen
on the Oxygen-Consumption Rate of the Mid-
water Copepod *Gaussia* Princeps,
W77-06642 5C

OXYGEN REQUIREMENTS

Effects of Pressure, Temperature and Oxygen
on the Oxygen-Consumption Rate of the Mid-
water Copepod *Gaussia* Princeps,
W77-06642 5C

Fish Diseases and Parasites in Relation to the
Environment,
W77-06744 5C

The Electrolytic Respirometer-II. Use in Water
Pollution Control Plant Laboratories,
W77-07081 5D

OXYGEN SOLUBILITIES

The Solubility of Nitrogen, Oxygen and Argon
in Water and Seawater,
W77-06923 5C

OXYGEN STRATIFICATION

Occurrence and Growth of *Dreissena*
Polymorpha Pall. in Lakes Included in a Cool-
ing System, (In Polish),
W77-06754 5C

OXYGENATION

The Use of Oxygen to Treat Sewage in a Rising
Main,
W77-06996 5D

Plug-In Concept for Pilot Sewage Treatment
Plant,
W77-07026 5D

Design Criteria for Waste Water Aerator
Drives,
W77-07060 5D

OYSTERS

Occurrence of Gas-Bubble Disease in Three
Species of Bivalve Molluscs,
W77-06921 5C

OZONATION

Oxidation and Ozonation Chamber,
W77-06999 5D

OZONE

Oxidation and Ozonation Chamber,
W77-06999 5D

Method of Applying Ozone and Sonic Energy
to Sterilize and Oxidize Waste Water,
W77-07007 5D

OZONE MATTER

Ozone Oxidation of Waste Water,
W77-07094 5D

PACIFIC OCEAN

An Analysis of Inertial Oscillations Observed
Near Oregon Coast,
W77-06892 2L

Particulate Transport of Radionuclides ¹⁴C and
⁵⁵Fe to Deep Waters in the Pacific Ocean,
W77-06902 5B

PACK ICE

Identification, Documentation, and Delineation
of Coastal Migratory Bird Habitat in Alaska,
and the Distribution, Abundance and Feeding
Ecology of Birds Associated with Pack Ice,
W77-06805 6G

PALOUSE RIVER BASIN (WASH)

Water in the Palouse River Basin, Washington,
W77-06978 4B

SUBJECT INDEX

PALOUSE RIVER BASIN (WASH)

PARALLEL-CHANNEL AQUIFERS

Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B

PARAMETRIC HYDROLOGY

On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A

Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A

PARASITISM

The Mining Fauna in Four Macrophyte Species in Mikolajskie Lake, W77-06688 5C

PARTICLE SIZE

Factors Influencing the Dewatering Characteristics of Sludge, W77-07097 5D

PARTICULATE PETROLEUM RESIDUES

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic, W77-06911 5B

PATENTS

Electron-Beam Irradiation of Waste Products--e.g., For Sterilization of Sewage Sludge and Waste Industrial Products, W77-06997 5D

Sludge Separator, W77-06998 5D

Oxidation and Ozonation Chamber, W77-06999 5D

Hydrocarbon Products Manufacture--By Carbonisation of Coal, Scrap Rubber or Plastic or Domestic Sewage Under Reduced Pressure, W77-07000 5D

Sewage Aeration Impeller-With Automatic De-Icing and Anti-Clogging System, W77-07001 5D

Apparatus for Disposal of Effluents, W77-07002 5E

Method of Waste Treatment and Algae Recovery, W77-07003 5D

Renovation of Waste Water, W77-07004 5D

Waste Treatment Apparatus, W77-07005 5D

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D

Method of Applying Ozone and Sonic Energy to Sterilize and Oxidize Waste Water, W77-07007 5D

Apparatus and Process for Removing Ammonia Nitrogen from Waste Water, W77-07008 5D

Device for Sucking the Upper Layer of a Polluted Water Surface, W77-07089 5G

Method of Treating Waste Water with Jet Nozzles, W77-07090 5D

Waste Treatment Process, W77-07091 5D

Clarifier with Overflow Scum Removal, W77-07092 5D

Process for the Purification of Waste Waters with Activated Carbon, W77-07093 5D

Ozone Oxidation of Waste Water, W77-07094 5D

PATH OF POLLUTANTS

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

Lake Currents and Temperatures Near the Western Shore of Lake Michigan, W77-06687 2H

Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B

Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C

Study of Leachate at Landfill Sites 1975, Volume 1, W77-06851 5B

Particulate Transport of Radionuclides 14C and 55Fe to Deep Waters in the Pacific Ocean, W77-06902 5B

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite, W77-06975 5B

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater, W77-06981 5B

PATHOGENIC FUNGI

Fish Diseases and Parasites in Relation to the Environment, W77-06744 5C

PATHOLOGY

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

PELAGIC ECOSYSTEMS

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

PENNSYLVANIA

Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations, W77-06676 4A

Flood Management Study, W77-06952 6F

Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B

PERMAFROST

Suprapermafrost Water, W77-06630 2C

PERMEABILITY

Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian), W77-06745 4C

PERSONNEL

The Operations Section of Lincoln Sewage Division, W77-07023 5D

PESTICIDES

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

PETROCHEMICAL WASTES

Hygienic Effectiveness of Measures for Decontaminating Effluents at Petrochemical Plants, (In Russian), W77-07069 5D

PETROLEUM HYDROCARBONS

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

PHAEOPHYTA

Long-Term Lead Accumulation in Abalone (*Haliotis* Spp.) Fed on Lead-Treated Brown Algae (*Egria laevigata*), W77-06776 5C

PHENOLS

Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A

SUBJECT INDEX

PLASTICS

PHOENIX (AZ)

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona.
W77-06954 4A

PHOSPHATE

Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds,
W77-07054 5B

PHOSPHATE REMOVAL

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment,
W77-07099 5D

PHOSPHATES

Phosphate Prediction Model for Streams by Means of Discriminant Analysis,
W77-06906 5B

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary,
W77-06910 5B

Phosphates in Soils Treated with Sewage Water: I. General Information on Sewage Farm, Soil, and Treatment Results,
W77-07052 5G

Phosphates in Soils Treated with Sewage Water: II. Fractionation of Accumulated Phosphates,
W77-07053 5B

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment,
W77-07099 5D

PHOSPHORUS

Automated Method for the Determination of the Phosphorus Content of Detergents,
W77-06944 5A

Influence of Phosphorus Removal on Solids Budget,
W77-07032 5D

Process Technological Background Regarding New Protective Regulations of Water Bodies-Results of Nitrification and Phosphorus Elimination Experiments in Zurich and Bern. III. Filtration by Flocculation for the Elimination of Phosphorus from Communal Waste Water (Verfahrenstechnische Unterlagen im Hinblick auf die neuen Gewässerschutzanforderungen-Ergebnisse der Versuche ueber: die Nitrifikation und Phosphorelimination in Zuerich und Bern. III. Flockungsfiltration zur Elimination von Phosphor aus Kommunalem Abwasser),
W77-07082 5D

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment,
W77-07099 5D

PHOSPHORUS COMPOUNDS

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields,
W77-06914 5B

PHOTOGRAMMETRY

Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery,
W77-06972 4A

PHOTOLYSIS

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation,
W77-07006 5D

PHOTOMETRY

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution,
W77-06697 5C

PHOTOSYNTHESIS

Some Effects on Integral Photosynthesis of Artificial Circulation of Phytoplankton Through Light Gradients,
W77-06696 5C

PHYTOPLANKTON

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment,
W77-06621 5A

Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment,
W77-06622 5A

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment,
W77-06625 5A

Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton,
W77-06637 5C

Limnological and Planktonic Studies in the Waterton Lakes, Alberta,
W77-06680 5C

Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character,
W77-06685 5C

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle,
W77-06692 5C

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes,
W77-06695 5C

Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish),
W77-06755 5C

Changes in the Structure of Phytoplankton During the First Years of Existence of the Derdap Storage Reservoir, (In Serbo-Croatian),
W77-06786 2H

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska,
W77-06836 6G

PIEDMONT REGION (NC)

Open Space and Urban Water Management - Phase II: Case Studies and Findings,
W77-06917 6B

PILGRIM NUCLEAR POWER STATION (MASS)

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station,
W77-06928 5G

PILOT PLANTS

Plug-In Concept for Pilot Sewage Treatment Plant,
W77-07026 5D

Sludge Dewatering Pilot Plant Design. Part 2,
W77-07088 5D

PIMEPHALES PROMELAS

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis,
W77-06611 5C

PISMO CLAMS

Effects of Engineering Activities on the Ecology of Pismo Clams,
W77-06886 5C

PITLESS ADAPTERS

Bits and Pieces,
W77-06866 8G

PITTING (CORROSION)

How to Deal with Pitting and Corrosion.
W77-06869 8G

PLAICE

The Accumulation of Organic Mercury from Sea Water by the Plaice, *Pleuronectes platessa* L.,
W77-06607 5C

PLANKTON

Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton,
W77-06637 5C

Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia princeps*,
W77-06642 5C

Measurements of Planktonic Biomass in a Reservoir,
W77-06679 5A

Ichthyoplankton of the Eastern Bering Sea,
W77-06845 6G

PLANNING

Use of a Parametric Model as a Tool for Hydrometric Network Planning,
W77-06710 2A

La Science des Systemes dans la Planification des Ressources en Eau,
W77-06736 6A

Environmental Impact Statements in Water Resources Planning and Decision Making,
W77-06738 6E

Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project,
W77-06739 6B

Open Space and Urban Water Management - Phase II: Case Studies and Findings,
W77-06917 6B

Who's Minding the Shore. A Citizens' Guide to Coastal Management,
W77-06935 5G

Fail-Safe Waste Treatment System,
W77-07027 5D

PLANTING MANAGEMENT

Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian),
W77-06745 4C

PLASTICS

Plastic Spheres for Waste Water Treatment.
W77-07028 5D

The Fabric-Lined Purification Basin.
W77-07035 5D

SUBJECT INDEX

PLASTICS

PLEISTOCENE EPOCH

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

PNEUMATIC GRAB

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

POIKILOOTHERMS

Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C

POLAND

Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish), W77-06755 5C

POLAND (KONIN AREA LAKES)

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C

The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C

POLAR REGIONS

Devon Island Ice Cap: Core Stratigraphy and Paleoclimate, W77-06890 2C

POLIOVIRUS 1

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

POLITICAL ASPECTS

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

POLITICAL CONSTRAINTS

Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply, W77-06700 5G

POLLUTANT IDENTIFICATION

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C

Water Chemistry and Water Quality, W77-06778 5A

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A

Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector, W77-06961 5A

Characterization of Soluble Organic Matter in Leachate, W77-07039 5A

Forms of Sulfur in Sewage Sludge, W77-07044 5A

Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent, W77-07045 5A

The Chemical Characteristics of the City of Winnipeg Waste Water, W77-07047 5A

Escherichia Coli as a Sanitary-Indicator Microorganism, (In Russian), W77-07067 5A

Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72, W77-07076 5A

The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A

POLLUTANTS

Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B

POLLUTION ABATEMENT

The Generation of Residual Flows in Norway: An Input-Output Approach, W77-06698 5G

Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G

Optimal Investment in Pollution Control Capital in a Neoclassical Growth Context, W77-06705 6G

An Input-Output Analysis of Environmental Preservation, W77-06706 6G

USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G

Pollution Prevention, Not Control Called Key to a Clean Environment, W77-06861 5G

Chicago Drives Large Bores to Control Combined Sewage Flow, W77-06988 8E

POLLUTION LICENSES

Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply, W77-06700 5G

POLLUTION SOURCE CONTROL

Pollution Prevention, Not Control Called Key to a Clean Environment, W77-06861 5G

POLLUTION TAXES (CHARGES)

Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply, W77-06700 5G

Effluent Charges and Pollution Control: A Case Study, W77-06701 5G

Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G

POLLUTION THRESHOLD

Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G

POLYCHLORINATED BIPHENYLS

An Offshore Biomonitoring System for Chlorinated Hydrocarbons, W77-06641 5A

Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in Ictalurus punctatus (Channel Catfish), W77-06759 5C

Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E

POLYMERS

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D

The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D

Purifying Water, W77-07061 5D

POLYNOMIAL PROCEDURE

An Approximating Polynomial for the Computation of Saturation Vapor Pressure, W77-06652 2B

PONDS

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

SUBJECT INDEX

PUMPKINSEED

- Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H
- Method of Waste Treatment and Algae Recovery, W77-07003 5D
- POP-EYE**
First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C
- POPULATION**
Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G
- PORT SAID**
Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L
- POTABLE WATER**
Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G
- POTASSIUM**
Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization, W77-06870 3F
- Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G
- POTATO PROCESSING WASTES**
State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D
- POTATOES**
Drying Potato Wastes for Animal Feed as an Alternative Disposal Method, W77-06947 5D
- POTENTIAL FLOW**
Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow, W77-06905 2F
- POWDER DRAINAGE BASIN (OR)**
Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G
- POWER OPERATIONS AND MAINTENANCE**
Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G
- POWER PLANTS**
Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G
- POWERPLANTS**
Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A
- An Annular Flow Ice-Water Model Heat Sink, W77-06889 2C
- PRECIPITATION (ATMOSPHERIC)**
The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.; Theory and Quantitative Models, W77-06675 2B
- Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H
- PREDATION**
Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A
- PRESERVATION**
The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G
- PRESSURE**
Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*, W77-06642 5C
- PRIBILOF ISLANDS**
Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G
- PRICE CURRENT METERS**
A Universal Calibration Equation for Price Meters and Similar Instruments, W77-06943 7B
- PRICING**
Collective Utility: A Systems Approach to Water Pricing Policy, W77-06712 6C
- PRIMARY PRODUCTION**
Loch Ewe Bag Experiment, 1974, W77-06627 5A
- Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish), W77-06755 5C
- PRIMARY PRODUCTIVITY**
Primary and Secondary Production of Plankton in Heated Lakes, (In Polish), W77-06752 5C
- Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G
- PRODUCTIVITY**
The Fauna of the Polluted River Tees Estuary, W77-06638 5C
- Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I
- Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H
- The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G
- PROFILES**
Profiles and Evaporation, W77-06898 2D
- PROJECTIONS**
Presenting Trends in Lake Eutrophication, W77-06693 5C
- PROJECTS**
General Description of the Vistula River Project and Basic Planning Data, W77-06733 4A
- PROTOZOA**
Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A
- The Toxic Effects of Selected Heavy Metals on Unadapted Populations of *Vorticella Convalaria* Var *Similis*, W77-06636 5C
- PRUDHOE BAY**
Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G
- PUBLIC HEALTH**
Health Effects of Multipurpose Use of Water, W77-06775 5C
- PUBLIC INVESTMENT**
The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D
- PUBLIC PARTICIPATION**
Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G
- PUBLICATIONS**
Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F
- PUERTO RICO**
Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico, W77-06632 5B
- PUGET SOUND**
A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C
- PULP AND PAPER INDUSTRY**
Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry, W77-06951 5D
- PULP WASTES**
Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D
- PUMPING**
Hydraulics and Economics of Well Field Layout, W77-06863 8B
- Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers, W77-06941 4B
- PUMPKINSEED**
Seasonal changes in the Respiration of Pumpkinseed, *Lepomis gibbosus*, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C

SUBJECT INDEX

PUMPS

PUMPS

It's All on the Nameplate: Everything You Always Wanted to Know About Jet Pumps, W77-06854 8C

Pumping Systems: The Simpler, The Better, W77-06856 8C

Submersible Pump Design: Dependent on Well Diameter and Depth, W77-06867 8C

How to Deal with Pitting and Corrosion, W77-06869 8G

QUANTITATIVE MODELS

The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.; Theory and Quantitative Models, W77-06675 2B

QUATERNARY PERIOD

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L

QUEBEC

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

RADIO-CHEMICAL ANALYSIS

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

RADIOACTIVE WASTE DISPOSAL

Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B

RADIOACTIVE WASTES

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

RADIOECOLOGY

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

RADIOISOTOPES

Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C

Particulate Transport of Radionuclides 14C and 55Fe to Deep Waters in the Pacific Ocean, W77-06902 5B

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater, W77-06981 5B

RAIN

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

RAINBOW TROUT

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

RAINFALL

Weather Modification in the Soviet Union--1976, W77-06644 3B

Area-Depth Relations for Frequency Values of Rainfall, W77-06647 2B

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B

RAINWATER MEASUREMENT

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

RARITAN BAY (NY)

Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C

RARITAN RIVER (NJ)

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River, W77-06953 4A

RECHARGE WELLS

Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow, W77-06905 2F

RECLAIMED WATER

Renovated Water from Municipal Sewage Treatment Plants, W77-07086 5D

RECREATION

A New Reservoir and Recreational Behavior, W77-06956 6B

RECREATION PARTICIPATION RATES

A New Reservoir and Recreational Behavior, W77-06956 6B

RECYCLING

State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment, W77-07099 5D

REDLANDS (CALIF)

USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G

REEFS

Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

REGENERATION BRINES

Septic Tank Study is Off and Running, W77-06859 5D

REGIONAL ANALYSIS

Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

REGIONAL DEVELOPMENT

Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

A Sector Model for Regional and National Water Resources Planning, W77-06731 6A

REGIONAL PLANNING

Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A

REGRESSION ANALYSIS

Surface Water Network Design by Regression Analysis Simulation, W77-06963 2E

REGULATION

Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G

Methods for Control of the Regimes for Water Resources Systems, W77-06717 4A

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

RELEASE RULES

Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A

REMOTE SENSING

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A

A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution, W77-06697 5C

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B

Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B

SUBJECT INDEX

RESOURCES DEVELOPMENT

- Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery, W77-06972 4A
- REPAIRING**
Cincinnati's Preventive Maintenance Sewer Program, W77-06989 5G
- REPRODUCTION**
Notes on the Nesting Success and Fecundity of the Anemonefish Amphiprion Clarkii at Miyake-Jima, Japan, W77-06763 5C
Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C
- RESEARCH**
Mathematical Models in Hydrology, W77-06708 2A
- RESERVOIR OPERATION**
Optimal Operations of Reservoirs in the Harz Mountains, W77-06715 4A
Optimal Design and Operation of Reservoir Systems, W77-06721 4A
Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A
- RESERVOIR RELEASES**
Optimal Operations of Reservoirs in the Harz Mountains, W77-06715 4A
- RESERVOIR STORAGE**
Optimal Operations of Reservoirs in the Harz Mountains, W77-06715 4A
- RESERVOIRS**
Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A
Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H
On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A
Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A
Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A
The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A
The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A
- Changes in the Structure of Phytoplankton During the First Years of Existence of the Derdap Storage Reservoir, (In Serbo-Croatian), W77-06786 2H
A New Reservoir and Recreational Behavior, W77-06956 6B
- RESISTANCE**
Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C
- RESOURCE DEVELOPMENT**
Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G
Razor Clam (Siliqua Patula, Dixon) Distribution and Population Assessment Study, W77-06830 6G
- RESOURCES DEVELOPMENT**
Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development, W77-06634 6B
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds, W77-06793 6G
Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G
Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G
Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatulus) and the Ringed Seal (Phoca (Pusa) hispida), W77-06799 6G
An Aerial Census of Spotted Seals, Phoca Vitulina Largha, W77-06800 6G
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G
Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G
Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G
Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G
Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G
- Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G
Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G
Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G
Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G
Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G
Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G
Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G
Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G
Avian Community Ecology of the Akulik - Inghalik River Delta, Norton Bay, Alaska, W77-06822 6G
A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G
Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral, W77-06825 6G
The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G
Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G
Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G
Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

SUBJECT INDEX

RESOURCES DEVELOPMENT

- Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G
- Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G
- Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G
- Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G
- Beaufort Sea Estuarine Fishery Study, W77-06840 6G
- The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G
- Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G
- Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G
- Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G
- Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G
- Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G
- Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G
- The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G
- A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines, W77-06850 5A
- The New York Bight Project - 1975; Stony Brook, Long Island, New York, W77-06876 5G
- A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L
- Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B
- State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development, W77-06934 6G
- Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

RESPIRATION

- Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C
- Seasonal changes in the Respiration of Pumpkinseed, *Lepomis gibbosus*, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C
- Respiratory Response of Cunners to Silver, W77-06789 5C
- The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

RETENTION

- A Method of Evaluating a Field Water Capacity Using PF-3, (In French), W77-06844 2G

REVIEWS

- Climatology for Geographers, W77-06659 2B
- State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D
- Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry, W77-06951 5D

RHEOTAXIS

- A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

RICE

- Salinity Effects on Rice After the Boot Stage, W77-06871 3C

RICE PADDY

- Salinity Effects on Rice After the Boot Stage, W77-06871 3C

RIFFLE INVERTEBRATES

- The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

RISKS

- Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G

RIVER BASIN DEVELOPMENT

- Hydrological Evaluation of Changes in Runoff Characteristics, W77-06732 4A

- General Description of the Vistula River Project and Basic Planning Data, W77-06733 4A

RIVER BASINS

- Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

- Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

- Modele Mathematique de Simulation du Systeme des Ressources Hydrauliques Superficielles du Llobregat, W77-06727 4A

- Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B

- The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A

- The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

- River Basin Snow Mapping at the National Environmental Satellite Service, W77-06915 2C

RIVER FLOW

- Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

RIVER LLOBREGAT (SPAIN)

- Modele Mathematique de Simulation du Systeme des Ressources Hydrauliques Superficielles du Llobregat, W77-06727 4A

RIVER SYSTEMS

- Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

- The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A

RIVER TEES ESTUARY (ENGLAND)

- The Fauna of the Polluted River Tees Estuary, W77-06638 5C

RIVERS

- Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

- Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72, W77-07076 5A

RNA SYNTHESIS

- LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

ROAD CONSTRUCTION

- Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

ROCK MECHANICS

- Conference on Research in Tunneling and Excavation Technology, W77-06885 8E

ROOT DISTRIBUTION

- Copper Sulfate Fights Root Growth in Sewer Systems, W77-06991 8G

ROOT SYSTEMS

- Copper Sulfate Fights Root Growth in Sewer Systems, W77-06991 8G

ROTARY DRILLING

- One Good Idea Spurs Another, W77-06860 8C

SUBJECT INDEX

SECONDARY PRODUCTIVITY

ROTENONE

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

RUNOFF

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

Hydrological Evaluation of Changes in Runoff Characteristics, W77-06732 4A

Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian), W77-06745 4C

Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H

Chicago Drives Large Bores to Control Combined Sewage Flow, W77-06988 8E

SAGINAW BAY (MICH)

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

SALINE WATER-FRESHWATER INTERFACES

Waste Injection into Stratified Ground Water Bodies, W77-06855 5B

SALINITY

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C

Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C

Salinity Effects on Rice After the Boot Stage, W77-06871 3C

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

SALMON

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A

SALMONIDS

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

SALT TOLERANCE

Salinity Effects on Rice After the Boot Stage, W77-06871 3C

SALTS

Some Factors Affecting Floc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D

SAMPLING

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

Electrically Powered Sampler for Benthic Macroinvertebrates, W77-06757 7B

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic, W77-06911 5B

SAN BERNADINO (CALIF)

USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G

SAN DIEGO AQUEDUCT (CALIF)

Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

SANDS

Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L

Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch), W77-06681 2G

SANTA ANA RIVER BASIN (CALIF)

Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

SATELLITE (ARTIFICIAL)

Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery, W77-06972 4A

SATELLITES (ARTIFICIAL)

A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B

SATURATION

An Approximating Polynomial for the Computation of Saturation Vapor Pressure, W77-06652 2B

SCHEDULING

A Sector Model for Regional and National Water Resources Planning, W77-06731 6A

SCHINDLER PLANKTON TRAP

Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A

SCREENS

Screenings Dewatering Press, W77-07029 5D

SEA-CLIFF BIRDS

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

SEA WATER

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater, W77-06923 5C

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

SEALS (SPOTTED)

An Aerial Census of Spotted Seals, Phoca Vitulina Larga, W77-06800 6G

SEASONAL

Seasonal changes in the Respiration of Pumpkinseed, Lepomis Gibbosus, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C

SECONDARY PRODUCTIVITY

Primary and Secondary Production of Plankton in Heated Lakes, (In Polish), W77-06752 5C

SUBJECT INDEX

SEDIMENT CONTROL

SEDIMENT CONTROL

Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G

Diminution Ratios for Planning Construction-Area Sediment Controls, W77-06980 4D

SEDIMENT DISCHARGE

Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian), W77-06745 4C

SEDIMENT-RUNOFF MODEL

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

SEDIMENT TRANSPORT

A Self-Contained Facility for Analyzing Near-Bottom Flow and Associated Sediment Transport, W77-06874 2L

A Test Particle Dispersion Study in Massachusetts Bay, W77-06880 2L

Littoral Drift Estimates Along the Coastline of Florida, W77-06882 2L

Incipient Sediment Motion in Entrances with Shell Beds, W77-06930 2L

Characteristics of Water Flow at the North End of the Wassaw Barrier Island Complex. Wassaw Island Erosion Study, Part II, W77-06939 2J

Changing Needs and Opportunities in the Sediment Field, W77-06964 2J

Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

SEDIMENT-WATER INTERFACES

The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes, W77-06741 5C

SEDIMENT YIELD

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

Current Methods Used in the Soil Conservation Service to Estimate Sediment Yield, W77-06657 4D

Changing Needs and Opportunities in the Sediment Field, W77-06964 2J

Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

SEDIMENTATION

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L

Monitoring the Marine Environment Through Sedimentation, W77-06651 2L

An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

Characteristics of Water Flow at the North End of the Wassaw Barrier Island Complex. Wassaw Island Erosion Study, Part II, W77-06939 2J

Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island. Wassaw Island Erosion Study, Part III, W77-06940 8G

Changing Needs and Opportunities in the Sediment Field, W77-06964 2J

Design and Control of Secondary Settlement Tanks, W77-07015 5D

Renovated Water from Municipal Sewage Treatment Plants, W77-07086 5D

SEDIMENTATION RATES

Current Methods Used in the Soil Conservation Service to Estimate Sediment Yield, W77-06657 4D

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

SEDIMENTS

Effects of Various Ecological Factors on Radiostromium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostromium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

Particulate Transport of Radionuclides ¹⁴C and ⁵⁵Fe to Deep Waters in the Pacific Ocean, W77-06902 5B

SEEPAGE

Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B

A Device for Measuring Seepage Flux in Lakes and Estuaries, W77-06903 7B

SEEPAGE FLUX

A Device for Measuring Seepage Flux in Lakes and Estuaries, W77-06903 7B

SEISMIC STUDIES

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

SELF PURIFICATION

Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G

On the Self-Purification of Natural Waters, (In German), W77-07038 5G

SENSORS

NASA Develops Water Monitoring System, W77-06912 5A

SEPARATION TECHNIQUE

Clarifier with Overflow Scum Removal, W77-07092 5D

SEPARATION TECHNIQUES

Partial Extraction of Metals from Aquatic Sediments, W77-06781 5A

Sludge Separator, W77-06998 5D

Apparatus for Disposal of Effluents, W77-07002 5E

Device for Sucking the Upper Layer of a Polluted Water Surface, W77-07089 5G

SEPTIC TANKS

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

Nutrient Removal and Sludge Disposal Within Septic Systems-Phase III, W77-06686 5D

Septic Tank Study is Off and Running, W77-06859 5D

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B

The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D

SETTLING BASINS

Design and Control of Secondary Settlement Tanks, W77-07015 5D

The Fabric-Lined Purification Basin, W77-07035 5D

SEWAGE

New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G

SEWAGE BACTERIA

Septic Tank Study is Off and Running, W77-06859 5D

SEWAGE DISPOSAL

Phosphates in Soils Treated with Sewage Water: II. Fractionation of Accumulated Phosphates, W77-07053 5B

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures, W77-07079 5D

Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D

SUBJECT INDEX

SLUDGE

SEWAGE EFFLUENTS

NASA Develops Water Monitoring System,
W77-06912 5A

Elimination of Anaerobic Digester Supernatant,
W77-07059 5D

SEWAGE SLUDGE

Laboratory Studies on the Effect of Metals on
Oxygen Uptake by Sewage Sludge in Brackish
Water,
W77-06788 5C

Acid Solubilization of Sewage Sludge and Ash
Constituents for Possible Recovery,
W77-07017 5E

Forms of Sulfur in Sewage Sludge,
W77-07044 5A

Application of Municipal Refuse and Liquid
Sewage Sludge to Agricultural Land: II.
Lysimeter Study,
W77-07080 5D

Composting of Sewage Sludge and Solid Waste
Matter,
W77-07084 5D

SEWAGE TREATMENT

Sewage Aeration Impeller-With Automatic De-
icing and Anti-Clogging System,
W77-07001 5D

Method of Waste Treatment and Algae
Recovery,
W77-07003 5D

Treatment of Sewage by Electrons and Gam-
mas,
W77-07012 5D

Fast-Tracking Cuts Costs 16% on Advanced
Waste Water Plant.
W77-07016 5D

Study on Sewage Flow Dynamics Through
Dorr Type Clarifier on Stream, (Synopsis),
W77-07048 5D

Phosphates in Soils Treated with Sewage
Water: I. General Information on Sewage
Farm, Soil, and Treatment Results,
W77-07052 5G

SEWARD PENINSULA (ALAS)

Birds of Coastal Habitat on the South Shore of
Seward Peninsula, Alaska,
W77-06813 6G

SEWERAGE

Anaerobic Digestion and Membrane Separation
for the Treatment of Domestic Sewage,
W77-06631 5D

Sewerage for a Rural Resort Area,
W77-06987 5D

Cincinnati's Preventive Maintenance Sewer
Program.
W77-06989 5G

Preventive Sewer Maintenance Helps Preserve
Historic Annapolis.
W77-06990 8G

Copper Sulfate Fights Root Growth in Sewer
Systems,
W77-06991 8G

Contract Services Stretch Sewer Maintenance
Budget,
W77-06994 8G

The Plight and Promise of On-Site Waste Water
Treatment,
W77-07010 5D

New Visibility for On-Site Waste Treatment
Systems,
W77-07013 5D

SEWERS

The Growth Shapers: The Land Use Impacts of
Infrastructure Investments.
W77-06601 6D

Control Sewer Corrosion with H2O2,
W77-06993 8G

The Use of Oxygen to Treat Sewage in a Rising
Main,
W77-06996 5D

SHADES CREEK BASIN

Urbanization and Flooding in Shades Creek
Basin, Jefferson County, Alabama,
W77-06977 4C

SHEET FLOW

Hydraulics of Sheet Flow in Wetlands,
W77-06929 8B

SHELLFISH

Adsorption of Polychlorinated Biphenyl
(Aroclor 1254) on Shrimp,
W77-06758 5C

Demersal Fish and Shellfish Assessment in
Selected Estuary Systems of Kodiak Island,
W77-06847 6G

SHORE BIRDS

Shorebird Dependence on Arctic Littoral
Habitats,
W77-06811 6G

SHORE PROTECTION

Sand Stabilization on the Dunes, Beach and
Shoreface of a Historically Eroding Barrier
Island. Wassaw Island Erosion Study, Part III,
W77-06940 8G

SHOREBIRDS

Birds of Coastal Habitat on the South Shore of
Seward Peninsula, Alaska,
W77-06813 6G

SHRIMP

Adsorption of Polychlorinated Biphenyl
(Aroclor 1254) on Shrimp,
W77-06758 5C

SHRINK-SWELL POTENTIAL

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

Oregon's Long Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

SILICA

Effects of Copper on Silicic Acid Uptake by a
Marine Phytoplankton Population: Controlled
Ecosystem Pollution Experiment,
W77-06621 5A

SILICIC ACID UPTAKE

Effects of Copper on Silicic Acid Uptake by a
Marine Phytoplankton Population: Controlled
Ecosystem Pollution Experiment,
W77-06621 5A

SILVER

Respiratory Response of Cunnners to Silver,
W77-06789 5C

SIMULATION ANALYSIS

Mathematical Models in Hydrology.
W77-06708 2A

On Large-Scale Simulation of Groundwater
Flow Systems,
W77-06713 4B

Optimal Operations of Reservoirs in the Harz
Mountains,
W77-06715 4A

Mathematical Model of Water Resources
Utilization in a River Basin,
W77-06719 4A

Optimal Design and Operation of Reservoir
Systems,
W77-06721 4A

Construction and Adjustment of a Two-Layer
Mathematical Model of the Llobregat Delta,
W77-06722 4A

Modele Mathematique de Simulation du
Systeme des Ressources Hydrauliques Super-
ficielles du Llobregat,
W77-06727 4A

Hybrid Computer Analysis of a Combined Sur-
face Water--Groundwater System,
W77-06729 4B

The Multi-Step Method for Simulation and Op-
timization of Vistula River Planning Alterna-
tives,
W77-06734 4A

The Out-of-Kilter Algorithm as a Single-Step
Method for Simulation and Optimization of
Vistula River Planning Alternatives,
W77-06735 4A

Further Development and Testing of a Stream-
Aquifer System Model,
W77-06762 2F

Surface Water Network Design by Regression
Analysis Simulation,
W77-06963 2E

SIPHONS

Lake Restoration by Bottom Water Siphoning
(In German),
W77-06689 5G

SKAHA LAKE (BRITISH COLUMBIA)

Presenting Trends in Lake Eutrophication.
W77-06693 5C

SKYLAB

A Study of the Utilization of EREP Data from
the Wabash River Basin,
W77-06670 7B

SLUDGE

Forms of Sulfur in Sewage Sludge,
W77-07044 5A

SUBJECT INDEX

SLUDGE

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

SLUDGE DIGESTION

Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E

Conditioning and Land Application of Aerobically Digested Sludge, W77-07058 5D

Elimination of Anaerobic Digester Supernatant, W77-07059 5D

SLUDGE DISPOSAL

Subsurface Injection-How Much Does It Cost, W77-07011 5E

Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E

Fluosolids Incinerator Commissioned at Esher, W77-07018 5E

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

Agricultural Disposal of Aerobic Wastewater Sludges in an Urban County, W77-07057 5D

Conditioning and Land Application of Aerobically Digested Sludge, W77-07058 5D

Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D

Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

SLUDGE SEPARATORS

Sludge Separator, W77-06998 5D

SLUDGE TREATMENT

Electron-Beam Irradiation of Waste Products--e.g., For Sterilization of Sewage Sludge and Waste Industrial Products, W77-06997 5D

Sludge Separator, W77-06998 5D

Sludge Incineration at Esher, W77-07020 5E

Screenings Dewatering Press, W77-07029 5D

The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D

Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D

Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D

Effect of Water Work's Sludge on Waste Water Treatment, W77-07085 5D

Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D

Factors Influencing the Dewatering Characteristics of Sludge, W77-07097 5D

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment, W77-07099 5D

SNAILS

Temperature Relations of Puget Sound Thais in Reference to Their Intertidal Distribution, W77-06767 5C

Dispersal and Dispersion of Pond Snails in an Experimental Environment Varying to Three Factors, Singly and in Combination, W77-06773 5C

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

SNAKE RIVER

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

SNOW SURVEYS

River Basin Snow Mapping at the National Environmental Satellite Service, W77-06915 2C

SOCIAL ASPECTS

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

SOCIAL IMPACT

A New Reservoir and Recreational Behavior, W77-06956 6B

SOCIAL PARTICIPATION

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

SOCKEY SALMON

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

SOIL CHEMICAL PROPERTIES

Indicator Values of Vascular Plants in Central Europe, (In German), W77-06803 2I

SOIL CONSERVATION

Current Methods Used in the Soil Conservation Service to Estimate Sediment Yield, W77-06657 4D

SOIL CONTAMINATION

Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B

SOIL DISPOSAL FIELD S

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B

SOIL EROSION

Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

SOIL MECHANICS

A Laboratory Study of Fluid and Soil Mechanics Processes During Hydraulic Dredging (Hydraulische und Bodentechnische Vorgänge beim Grundsaugen), W77-06883 8D

SOIL MOISTURE

Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F

Smoothing Data with Cubic Splines, W77-06831 7C

The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

A Method of Evaluating a Field Water Capacity Using PF-3, (In French), W77-06844 2G

SOIL PROFILES

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

SOIL PROPERTIES

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Grande Ronde Drainage Basin, W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

SUBJECT INDEX

STERILANTS

SOIL SURVEYS

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

SOIL TEXTURE

Depth and Seasonal Fluctuations in the Condi-
tion of the Groundwater of the Area Around
the City of Ghent (Belgium), (In Dutch),
W77-06681 2G

SOIL TYPES

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

Nutrient Removal and Sludge Disposal Within
Septic Systems-Phase III,
W77-06686 5D

A Laboratory Study of Fluid and Soil
Mechanics Processes During Hydraulic
Dredging (Hydraulische und Bodentechnische
Vorgänge beim Grundsaugen),
W77-06883 8D

SOIL WATER MOVEMENT

Suprapermafrost Water,
W77-06630 2C

SOILS

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

Phosphates in Soils Treated with Sewage
Water: I. General Information on Sewage
Farm, Soil, and Treatment Results,
W77-07052 5G

Solubility and Plant Uptake of Cadmium in
Soils Amended with Cadmium and Sewage
Sludge,
W77-07055 5B

SOLID WASTES

Drying Potato Wastes for Animal Feed as an
Alternative Disposal Method.
W77-06947 5D

Composting of Sewage Sludge and Solid Waste
Matter,
W77-07084 5D

SOLIDS CONTACT PROCESSES

Advanced Waste Treatment Seminar, Session
III, Removal of Solids and Organics, Held at
San Francisco, on October 28-29, 1970.
W77-07074 5D

SOLUBILITY

The Solubility of Nitrogen, Oxygen and Argon
in Water and Seawater,
W77-06923 5C

Solubility and Plant Uptake of Cadmium in
Soils Amended with Cadmium and Sewage
Sludge,
W77-07055 5B

SOLUBILITY EQUATIONS

The Solubility of Nitrogen, Oxygen and Argon
in Water and Seawater,
W77-06923 5C

SOUND WAVES

Method of Applying Ozone and Sonic Energy
to Sterilize and Oxidize Waste Water,
W77-07007 5D

SOUTH CAROLINA

Algal Supplement Enhancement of Static and
Recirculating System,
W77-06933 5C

SOUTH PLATTE RIVER BASIN (COLO)

Water Quality Investigations in the South Platte
River Basin, Colorado, 1971-72.
W77-07076 5A

SPATIAL DISTRIBUTION

Influence of Gradient on the Distribution of
Fishes in Conowingo Creek, Maryland and
Pennsylvania,
W77-06635 2I

Mississippi Sound Temporal and Spatial Dis-
tribution of Nutrients,
W77-06932 5B

SPAWNING

Spawning Herring Surveys in the Bering Sea
and Finfish Resource Surveys in Norton Sound
and Kotzebue Sound,
W77-06828 6G

SPECIES COMPOSITION

Response of Macro-Zooplankton Populations
to Copper: Controlled Ecosystem Pollution Ex-
periment,
W77-06620 5A

SPECIFIC GRAVITY

Device for Sucking the Upper Layer of a Pol-
luted Water Surface,
W77-07089 5G

SPILLWAYS

Effect of Atmospheric Gas Supersaturation
Caused by Dams on Salmon and Steelhead
Trout of the Snake and Columbia Rivers (A
Review of the Problem and the Progress
Toward a Solution, 1974),
W77-06927 5C

SPORES

Effect of Salinity on Spore Germination of Ter-
restrial and Marine Fungi,
W77-06772 5C

ST. LAWRENCE RIVER

Nutrients, Chlorophyll, and Internal Tides in
the St. Lawrence Estuary,
W77-06910 5B

STABILITY

Profiles and Evaporation,
W77-06898 2D

STABILIZATION

Sand Stabilization on the Dunes, Beach and
Shoreface of a Historically Eroding Barrier
Island, Wassaw Island Erosion Study, Part III,
W77-06940 8G

STATISTICAL METHODS

Smoothing Data with Cubic Splines,
W77-06831 7C

STATISTICS

Smoothing Data with Cubic Splines,
W77-06831 7C

STEAM

Guidelines for the Preparation of Environmen-
tal Reports for Fossil-Fueled Steam Electric
Generating Stations,
W77-06918 6G

STEAM GENERATING STATIONS

First Reported Incidence of Gas-Bubble Dis-
ease in the Heated Effluent of a Steam
Generating Station,
W77-06922 5C

STEELHEAD TROUT

Effect of Atmospheric Gas Supersaturation
Caused by Dams on Salmon and Steelhead
Trout of the Snake and Columbia Rivers (A
Review of the Problem and the Progress
Toward a Solution, 1974),
W77-06927 5C

STEMFLOW

Investigation of Precipitation Within Forest
Ecosystems, (In Hungarian),
W77-06797 2B

STERILANTS

Method of Applying Ozone and Sonic Energy
to Sterilize and Oxidize Waste Water,
W77-07007 5D

SUBJECT INDEX

STERILANTS

STOCHASTIC PROGRAMMING

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

STORAGE

Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H

STORM RUNOFF

Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania, W77-06969 4C

London's Stormwater Problem, W77-06983 5D

Sediments and Water Quality of Urban Storm Water, W77-06984 5B

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

Introduction to Urban Storm Water Runoff Models, W77-07071 5B

Simplified Methods of Computing the Quantity of Urban Runoff, W77-07072 5B

The WRE Storm Model, W77-07073 5B

On-Line Adaptive Control for Combined Sewer Systems, W77-07100 5D

STORM WATER

An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

London's Stormwater Problem, W77-06983 5D

Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B

Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

Integrated Approach to Urban Waste Water Management, W77-07095 5D

On-Line Adaptive Control for Combined Sewer Systems, W77-07100 5D

STORMS

Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B

STRAIT OF JUAN DE FUCA

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

STRATIGRAPHY

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L

STREAM-AQUIFER MODELS

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

STREAMFLOW

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

Surface Water Network Design by Regression Analysis Simulation, W77-06963 2E

STREAMS

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72, W77-07076 5A

STRENGTH

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

SUB-LETHAL EFFECTS

Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A

SUBLETHAL EFFECTS

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

SUBMERGED OFFSHORE DIFFUSER

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

SUBMERSIBLE PUMPS

Pumping Systems: The Simpler, The Better, W77-06856 8C

Submersible Pump Design: Dependent on Well Diameter and Depth, W77-06867 8C

SUBSURFACE FLOW

Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations, W77-06965 2F

SUBSURFACE INJECTION

Subsurface Injection-How Much Does It Cost, W77-07011 5E

SUBSURFACE INVESTIGATIONS

On Large-Scale Simulation of Groundwater Flow Systems, W77-06713 4B

SUBTROPIC

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

SUGARCANE

Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico, W77-06632 5B

SULFATES

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

SULFIDES

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

SULFUR COMPOUNDS

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

Forms of Sulfur in Sewage Sludge, W77-07044 5A

SUPERSATURATION

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam, W77-06919 5C

Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (*Oncorhynchus Nerka*), W77-06924 5C

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

SUPRAPERMAFROST WATER

Suprapermafrost Water, W77-06630 2C

SURFACE MINING

Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G

SURFACE RESISTANCE

Evaporation and Advection II: Evaporation Downwind of a Boundary Separating Regions Having Different Surface Resistances and Available Energies, W77-06897 2D

SURFACE WATERS

Modele Mathematique de Simulation du Systeme des Ressources Hydrauliques Superficielles du Llobregat, W77-06727 4A

SUBJECT INDEX

TERTIARY TREATMENT

- Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B
- Hybrid Computer Analysis of a Combined Surface Water--Groundwater System, W77-06729 4B
- Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C
- Surface Water Network Design by Regression Analysis Simulation, W77-06963 2E
- SURFACES**
- Evaporation and Advection II: Evaporation Downwind of a Boundary Separating Regions Having Different Surface Resistances and Available Energies, W77-06897 2D
- SURFACTANTS**
- LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C
- SURVEYS**
- Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G
- The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G
- Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C
- Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeith Counties, Texas, W77-06970 4B
- Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B
- SUSPENDED SOLIDS**
- Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I
- Design and Control of Secondary Settlement Tanks, W77-07015 5D
- SWINE-WASTE LAGOONS**
- Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B
- SYRDARYA RIVER (MIDDLE ASIA)**
- Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A
- SYSTEM SCIENCE**
- La Science des Systemes dans la Planification des Ressources en Eau, W77-06736 6A
- SYSTEMS ANALYSIS**
- La Science des Systemes dans la Planification des Ressources en Eau, W77-06736 6A
- TAHOE-TRUCKEE WATER SYSTEM (NEV AND CALIF)**
- Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B
- TASTE**
- Identity, Origin and Development of Off-Flavors in Great Lakes Anadromous Fish, W77-06931 5A
- TECHNOLOGY**
- A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A
- TECHNOLOGY TRANSFER**
- Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario, W77-06950 5D
- TELEOSTS**
- Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C
- TEMPERATURE**
- Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*, W77-06642 5C
- A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B
- Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina, W77-06654 2L
- The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C
- Seasonal changes in the Respiration of Pumpkinseed, *Lepomis gibbosus*, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C
- The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C
- Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C
- Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G
- Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G
- TEMPERATURE LIMITATION**
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G
- Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G
- TEMPERATURE PROFILES**
- A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B
- TEMPORAL DISTRIBUTION**
- Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B
- TENCH**
- Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur do la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C
- TERRACING**
- Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F
- TERTIARY TREATMENT**
- Expansion Comes Quickly to AWT Plant, W77-07009 5D
- Fast-Tracking Cuts Costs 16% on Advanced Waste Water Plant, W77-07016 5D
- Plug-In Concept for Pilot Sewage Treatment Plant, W77-07026 5D
- Fail-Safe Waste Treatment System, W77-07027 5D

SUBJECT INDEX

TEXAS

TEXAS

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B

Control Sewer Corrosion with H2O2, W77-06993 8G

THANITE

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

THAWING SOILS

Suprapermafrost Water, W77-06630 2C

THEIS EQUATION

Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow, W77-06905 2F

THERMAL POLLUTION

Lake Currents and Temperatures Near the Western Shore of Lake Michigan, W77-06687 2H

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish), W77-06750 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C

Primary and Secondary Production of Plankton in Heated Lakes, (In Polish), W77-06752 5C

The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish), W77-06755 5C

The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C

Growth and Movement of Fish in the Vicinity of a Thermal Discharge, W77-06766 5C

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

THERMAL POWER

Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G

THERMAL POWER PLANTS

Guidelines for the Preparation of Environmental Reports for Fossil-Fueled Steam Electric Generating Stations, W77-06918 6G

THERMAL SPRINGS

Mineral Content of Selected Geothermal Waters, W77-06667 3E

The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C

THERMAL STRATIFICATION

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

THERMAL TUNNELING

Cost Comparison Between Subterranean and Current Tunneling Methods, W77-06662 8A

Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A

Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix B--Subterranean Cost Analyses, W77-06664 8A

THERMOCLINE

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

THIN FILM CHEMISTRY

Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D

THREE-DIMENSIONAL MODELS

Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H

TIDAL WATERS

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

TIME

Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B

TOXICANTS

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

TOXICITY

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry, W77-06612 5C

Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta), W77-06628 5C

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of Vorticella Convallaria Var Similis, W77-06636 5C

The Influence of Acrolein and Hydrocrylic on the Development Dynamics of Aquatic Bacteria, W77-06690 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

Median Tolerance Limits of Some Chemicals to the Fresh Water Fish Cyprinus-Carpio, W77-06780 5C

TOXINS

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of Vorticella Convallaria Var Similis, W77-06636 5C

UNOX System for Waste Water Treatment, W77-07014 5D

TRACE ELEMENTS

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B

Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A

TRACERS

The Accumulation of Organic Mercury from Sea Water by the Plaice, Pleuronectes platessa L., W77-06607 5C

Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L

TRACKING TECHNIQUES

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater, W77-06981 5B

TRANSFER FACTORS (HYDROLOGIC)

Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H

TREATMENT FACILITIES

Canwel Can Do, W77-06985 5D

SUBJECT INDEX

URBAN WATER MANAGEMENT

Sewerage for a Rural Resort Area,
W77-06987 5D

Sludge Separator.
W77-06998 5D

Expansion Comes Quickly to AWT Plant,
W77-07009 5D

New Visibility for On-Site Waste Treatment
Systems,
W77-07013 5D

Fast-Tracking Cuts Costs 16% on Advanced
Waste Water Plant.
W77-07016 5D

Fluosolids Incinerator Commissioned at Esher,
W77-07018 5E

Sludge Incineration at Esher.
W77-07020 5E

Waste Water Treatment Plant Built in Wet
Hole,
W77-07021 5D

The Operations Section of Lincoln Sewage
Division,
W77-07023 5D

Energy Conservation and Heat Recovery in
Waste Water Treatment Plants,
W77-07024 5D

Municipal Waste Water Treatment as an Indus-
trial Operation,
W77-07025 5D

Plug-In Concept for Pilot Sewage Treatment
Plant,
W77-07026 5D

Fail-Safe Waste Treatment System,
W77-07027 5D

The Fabric-Lined Purification Basin.
W77-07035 5D

Upgrading Biological Sewage Treatment Plants
Today,
W77-07062 5D

TREES
Irrigation of the Nebit-Dag Plantings by
Mineralized Ground Water, (In Russian),
W77-06691 3C

TRICKLING FILTER
Renovated Water from Municipal Sewage
Treatment Plants,
W77-07086 5D

TRITIUM
LAS Inhibition of Diffusion and Uptake of
Tritiated Uridine During Teleost Embryogene-
sis,
W77-06611 5C

TROPHIC LEVEL
Dynamics of Phytoplankton Biomass in Two
Lakes of Different Limnological Character,
W77-06685 5C

The Historic and Present Relationships
Between Phytoplankton, Limiting Nutrients,
and Sediment-Water Geochemical Processes in
Selected Maine Lakes,
W77-06741 5C

TROPHIC LEVELS

Ecosystem Dynamics Birds and Marine Mam-
mals. Part I: Preliminary Estimates of Pinniped
- Finfish Relationships in the Bering Sea,
W77-06806 6G

TROUT

Reproductive Cycle of Trout and Tench: Effect
of Experimental Variations of the Tempera-
ture, (Etude Sur le Cycle Reproducteur de la
Truite Arc-En-Ciel et de la Tanche: Effet de
Variations Experimentales de la Temperature),
W77-06779 5C

A Preliminary Evaluation of the Effects of Gas
Bubble Disease on Fish Populations in the
Kootenai River Below Libby Dam,
W77-06919 5C

TULALIP INDIAN RESERVATION (WASH)

Preliminary Assessment of the Water
Resources of the Tulalip Indian Reservation,
Washington,
W77-06971 4A

TUNNEL BORING

Conference on Research in Tunneling and Ex-
cavation Technology,
W77-06885 8E

TUNNEL CONSTRUCTION

Slipform Paver, Steel Forms Speed Lining of
25,000-Foot Sewer Tunnel,
W77-06992 8F

TUNNEL LININGS

Slipform Paver, Steel Forms Speed Lining of
25,000-Foot Sewer Tunnel,
W77-06992 8F

TUNNELING

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods,
W77-06662 8A

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods, Appendix A--Baseline
Cost Analyses,
W77-06663 8A

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods, Appendix B--Subter-
rene Cost Analyses,
W77-06664 8A

Conference on Research in Tunneling and Ex-
cavation Technology,
W77-06885 8E

TUNNELING MACHINES

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods,
W77-06662 8A

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods, Appendix A--Baseline
Cost Analyses,
W77-06663 8A

Cost Comparison Between Subterrene and Cur-
rent Tunneling Methods, Appendix B--Subter-
rene Cost Analyses,
W77-06664 8A

TURBULENCE

Investigation of the Effects of Nonhomogene-
ous (or Nonstationary) Behavior on the Spectra
of Atmospheric Turbulence,
W77-06678 2B

Evidence for Strong Currents and Turbulence
in a Deep Coral Reef Groove,
W77-06904 2L

TURKEY

The Effect of Different Methods on Growth,
Development and Yield of Cotton, (In Ger-
man),
W77-06962 3F

UMATILLA RIVER BASIN (OR)

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Umatilla Drainage Basin,
W77-06602 2G

UNDERFLOW

Underflow from Sludge-Irrigated Cropland,
W77-07056 5B

UNDERGROUND WASTE DISPOSAL

Review and Analysis of Hydrogeologic Condi-
tions Near the Site of a Potential Nuclear
Waste Repository, Eddy and Lea Counties,
New Mexico,
W77-06974 5B

UNIT HYDROGRAPHS

Simplified Methods of Computing the Quantity
of Urban Runoff,
W77-07072 5B

UNIVERSAL SOIL LOSS EQUATION

Current Methods Used in the Soil Conservation
Service to Estimate Sediment Yield,
W77-06657 4D

UPWELLING

Exchange Through a Barrier Island Inlet: Addi-
tional Evidence of Upwelling Off the Northeast
Coast of North Carolina,
W77-06654 2L

Circulation and Hydrographic Structure Over
the Ghana Continental Shelf During the 1974
Upwelling,
W77-06893 2L

URAL RIVER BASIN (USSR)

Causes of the Drying up of Forests in the Flood
Plain of the Lower Reaches of the Ural River,
(In Russian),
W77-06801 4D

URBAN DRAINAGE

Integrated Approach to Urban Waste Water
Management,
W77-07095 5D

URBAN HYDROLOGY

Open Space and Urban Water Management -
Phase II: Case Studies and Findings,
W77-06917 6B

URBAN RUNOFF

Sediments and Water Quality of Urban Storm
Water,
W77-06984 5B

Introduction to Urban Storm Water Runoff
Models,
W77-07071 5B

Simplified Methods of Computing the Quantity
of Urban Runoff,
W77-07072 5B

The WRE Storm Model,
W77-07073 5B

URBAN WATER MANAGEMENT

Open Space and Urban Water Management -
Phase II: Case Studies and Findings,
W77-06917 6B

SUBJECT INDEX

URBANIZATION

URBANIZATION

Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C

URIDINE

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

USSR

Weather Modification in the Soviet Union--1976, W77-06644 3B

USSR (KAZAN)

Hygienic Effectiveness of Measures for Decontaminating Effluents at Petrochemical Plants, (In Russian), W77-07069 5D

USSR (POLAZNENSKY DEPOSIT)

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

UTAH

Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project, W77-06739 6B

VANCOUVER ISLAND

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L

VAPOR PRESSURE

An Approximating Polynomial for the Computation of Saturation Vapor Pressure, W77-06652 2B

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

VAPOR PRESSURE GRADIENTS

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, W77-06653 7B

VARIABILITY

Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A

Measurements of Planktonic Biomass in a Reservoir, W77-06679 5A

VARVES

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northwestern Minnesota, W77-06901 2J

VASCULAR PLANTS

Indicator Values of Vascular Plants in Central Europe, (In German), W77-06803 2I

VEGETABLE CROPS

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

VEGETATION

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

VEGETATION EFFECTS

Place and Role of Plant Cover in Optimization of the Donbas Natural Environment, (In Ukrainian), W77-06858 4C

VERMICULITE

Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G

VERTICAL MIGRATION

Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*, W77-06642 5C

VIBRIO PARAHAEOLYTICUS

Environmental Factors Affecting Survival and Growth of *Vibrio Parahaemolyticus*. A Review, W77-06765 5C

VIRGINIA

Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B

Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L

VIRUSES

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

VISTULA RIVER (POLAND)

General Description of the Vistula River Project and Basic Planning Data, W77-06733 4A

The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A

The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

VORTICELLA CONVALLARIA VAR SIMILIS

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of *Vorticella Convallaria* Var *Similis*, W77-06636 5C

WABASH RIVER BASIN (IND)

A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B

WALNUT CREEK BASIN (KAN)

Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F

WALTHAM (MA)

New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G

WARM SPRINGS DAM (ARIZ)

Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E

WARNING SYSTEMS

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

WASHINGTON

Temperature Relations of Puget Sound Thaids in Reference to Their Intertidal Distribution, W77-06767 5C

Potassium in an Arid Loessial Soil: Change in Availability as Related to Cropping and Fertilization, W77-06870 3F

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington, W77-06971 4A

Water in the Palouse River Basin, Washington, W77-06978 4B

WASTE DILUTION

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

WASTE DISPOSAL

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E

Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario, W77-06950 5D

Apparatus for Disposal of Effluents, W77-07002 5E

Expansion Comes Quickly to AWT Plant, W77-07009 5D

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

WASTE DISPOSAL FIELDS

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B

WASTE OIL DISPOSAL

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

WASTE TREATMENT

Adjustment Costs and Optimal Waste Treatment, W77-06699 5D

SUBJECT INDEX

WASTE WATER TREATMENT

- Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E
- Hydrocarbon Products Manufacture--By Carbonisation of Coal, Scrap Rubber or Plastic or Domestic Sewage Under Reduced Pressure. W77-07000 5D
- Expansion Comes Quickly to AWT Plant, W77-07009 5D
- New Visibility for On-Site Waste Treatment Systems, W77-07013 5D
- Fluosolids Incinerator Commissioned at Esher, W77-07018 5E
- Sludge Incineration at Esher. W77-07020 5E
- WASTE WATER DISPOSAL**
- Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B
- Waste Injection into Stratified Ground Water Bodies, W77-06855 5B
- WASTE WATER (POLLUTION)**
- Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A
- WASTE WATER TREATMENT**
- Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D
- Adjustment Costs and Optimal Waste Treatment, W77-06699 5D
- The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F
- Water Decontamination in Northern Regions by Impulse Electric Charges, (In Russian), W77-06791 5D
- Septic Tank Study is Off and Running. W77-06859 5D
- Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D
- State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D
- Proceedings Technology Transfer Seminar on Waste Handling, Disposal and Recovery in the Metal Finishing Industry, November 12-13, 1975, Toronto, Ontario. W77-06950 5D
- Literature Review of Wastewater Characteristics and Abatement Technology in the Wood and Timber Processing Industry. W77-06951 5D
- Canwel Can Do, W77-06983 5D
- Sewerage for a Rural Resort Area, W77-06987 5D
- The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D
- Electron-Beam Irradiation of Waste Products--e.g., For Sterilization of Sewage Sludge and Waste Industrial Products. W77-06997 5D
- Sludge Separator. W77-06998 5D
- Oxidation and Ozonation Chamber, W77-06999 5D
- Sewage Aeration Impeller-With Automatic De-Icing and Anti-Clogging System, W77-07001 5D
- Method of Waste Treatment and Algae Recovery, W77-07003 5D
- Renovation of Waste Water, W77-07004 5D
- Waste Treatment Apparatus, W77-07005 5D
- Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D
- Method of Applying Ozone and Sonic Energy to Sterilize and Oxidize Waste Water, W77-07007 5D
- Apparatus and Process for Removing Ammonia Nitrogen from Waste Water, W77-07008 5D
- Expansion Comes Quickly to AWT Plant, W77-07009 5D
- The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D
- Treatment of Sewage by Electrons and Gammamas, W77-07012 5D
- New Visibility for On-Site Waste Treatment Systems, W77-07013 5D
- UNOX System for Waste Water Treatment, W77-07014 5D
- Design and Control of Secondary Settlement Tanks, W77-07015 5D
- Fast-Tracking Cuts Costs 16% on Advanced Waste Water Plant. W77-07016 5D
- Waste Water System Uses Microwaves, W77-07019 5D
- Municipal Waste Water Treatment as an Industrial Operation, W77-07025 5D
- Plug-In Concept for Pilot Sewage Treatment Plant, W77-07026 5D
- Fail-Safe Waste Treatment System, W77-07027 5D
- Plastic Spheres for Waste Water Treatment. W77-07028 5D
- Screenings Dewatering Press. W77-07029 5D
- Sludge Dewatering on Alaska's North Slope, W77-07030 5D
- Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D
- Influence of Phosphorus Removal on Solids Budget, W77-07032 5D
- The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D
- Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D
- The Fabric-Lined Purification Basin. W77-07035 5D
- Nutrient Removal by Water Hyacinths, W77-07036 5G
- Backwashing of Granular Filters, W77-07037 5D
- Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D
- Some Factors Affecting Floc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D
- The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D
- Plant Data Analysis of Temperature Significance in the Activated Sludge Process, W77-07046 5D
- Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D
- Phosphates in Soils Treated with Sewage Water: I. General Information on Sewage Farm, Soil, and Treatment Results, W77-07052 5G
- Elimination of Anaerobic Digester Supernatant, W77-07059 5D
- Design Criteria for Waste Water Aerator Drives, W77-07060 5D
- Purifying Water, W77-07061 5D
- Upgrading Biological Sewage Treatment Plants Today, W77-07062 5D
- Stabilisation Lagoons Including Experience in Brazil. Part I, W77-07063 5D
- The Current Role of Wastewater Disinfection, W77-07064 5D
- Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D
- Experience in Treating Waste Waters from the Donetsk Mines, (In Russian), W77-07068 5D
- Hygienic Effectiveness of Measures for Decontaminating Effluents at Petrochemical Plants, (In Russian), W77-07069 5D

SUBJECT INDEX

WASTE WATER TREATMENT

Advanced Waste Treatment Seminar, Session III, Removal of Solids and Organics, Held at San Francisco, on October 28-29, 1970. W77-07074 5D

Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2, W77-07077. 5D

Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures, W77-07079 5D

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

Process Technological Background Regarding New Protective Regulations of Water Bodies-Results of Nitrification and Phosphorus Elimination Experiments in Zurich and Bern. III. Filtration by Flocculation for the Elimination of Phosphorus from Communal Waste Water (Verfahrenstechnische Unterlagen im Hinblick auf die neuen Gewaesserschutzanforderungen-Ergebnisse der Versuche ueber die Nitrifikation und Phosphorelimination in Zurich und Bern. III. Flockungsfiltration zur Elimination von Phosphor aus Kommunalem Abwasser), W77-07082 5D

Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D

Effect of Water Work's Sludge on Waste Water Treatment, W77-07085 5D

Renovated Water from Municipal Sewage Treatment Plants, W77-07086 5D

Waste Water Reuse Practice in the United States, W77-07087 5D

Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D

Method of Treating Waste Water with Jet Nozzles, W77-07090 5D

Waste Treatment Process, W77-07091 5D

Clarifier with Overflow Scum Removal, W77-07092 5D

Process for the Purification of Waste Waters with Activated Carbon, W77-07093 5D

Ozone Oxidation of Waste Water, W77-07094 5D

Factors Influencing the Dewatering Characteristics of Sludge, W77-07097 5D

Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A

Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment, W77-07099 5D

WASTEWATER TREATMENT

Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D

WATER ALLOCATION (POLICY)

The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

WATER ANALYSIS

Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B

Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

WATER BALANCE

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

A Model for the Water Regime of a Deciduous Forest with Special Consideration of the Functional Interrelationships Among Meteorological Factors, Soil Water Content and Evapotranspiration, (In German), W77-06864 2A

WATER BIRDS

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska, W77-06810 6G

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

WATER CHEMISTRY

Water Chemistry and Water Quality, W77-06778 5A

Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B

Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K

WATER CIRCULATION

Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

WATER CONSERVATION

Waste Water Reuse Practice in the United States, W77-07087 5D

WATER COOLING

An Annular Flow Ice-Water Model Heat Sink, W77-06889 2C

WATER DEFICIENCY

Indices of Water Restriction and Water Deficiency Tolerance, W77-06711 6A

WATER DEMAND

Indices of Water Restriction and Water Deficiency Tolerance, W77-06711 6A

Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

Water in the Palouse River Basin, Washington, W77-06978 4B

Waste Water Reuse Practice in the United States, W77-07087 5D

WATER DISTRIBUTION (APPLIED)

The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A

WATER DISTRICTS

Cincinnati's Preventive Maintenance Sewer Program, W77-06989 5G

The Operations Section of Lincoln Sewage Division, W77-07023 5D

WATER HYACINTH

Nutrient Removal by Water Hyacinths, W77-07036 5G

WATER LEVEL FLUCTUATIONS

Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch), W77-06681 2G

WATER LEVELS

Lake Ontario Atlas: Surface Waves, W77-06884 2H

WATER MANAGEMENT (APPLIED)

Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

A Dynamic Multisector Programming Approach to Regional Water Resource Management, W77-06737 6A

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

Integrated Approach to Urban Waste Water Management, W77-07095 5D

WATER POLICY

Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

SUBJECT INDEX

WATER POLLUTION SOURCES

- Mathematical Models in Hydrology.
W77-06708 2A
- Collective Utility: A Systems Approach to Water Pricing Policy.
W77-06712 6C
- WATER POLLUTION**
- Monitoring Groundwater Quality: Illustrative Examples.
W77-06673 5A
- Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska.
W77-06810 6G
- Seasonal Distribution and Abundance of Marine Birds.
W77-06815 6G
- A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines.
W77-06850 5A
- Pollution Prevention, Not Control Called Key to a Clean Environment.
W77-06861 5G
- Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed.
W77-06908 5B
- Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers.
W77-06957 6G
- WATER POLLUTION CONTROL**
- Means for Protecting the Drinking Water Quality of Lake George, New York.
W77-06682 5G
- Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply.
W77-06700 5G
- Effluent Charges and Pollution Control: A Case Study.
W77-06701 5G
- Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin.
W77-06707 5G
- The Legal Responsibility of Water Well Drillers.
W77-06862 5G
- What's New in Landfill Liners.
W77-07051 5G
- WATER POLLUTION EFFECTS**
- LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis.
W77-06611 5C
- Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment.
W77-06620 5A
- Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment.
W77-06622 5A
- Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment.
W77-06623 5A
- Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment.
W77-06624 5A
- Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment.
W77-06625 5A
- Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (*Salmo Gairdneri*).
W77-06639 5C
- The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex. (In Polish).
W77-06749 5C
- The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna. (In Polish).
W77-06750 5C
- The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters. (In Polish).
W77-06751 5C
- Primary and Secondary Production of Plankton in Heated Lakes. (In Polish).
W77-06752 5C
- The Influence of Heated Effluent Waters on the Water Chemistry of Konin Lakes. (In Polish).
W77-06753 5C
- The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex. (In Polish).
W77-06756 5C
- Health Effects of Multipurpose Use of Water.
W77-06775 5C
- Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*.
W77-06780 5C
- Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel.
W77-06782 5C
- Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae.
W77-06783 5C
- A Preliminary Survey of Mercury in Fish from Bombay and Thana Environment.
W77-06785 5C
- Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska.
W77-06812 6G
- Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska.
W77-06813 6G
- Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound.
W77-06828 6G
- A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca.
W77-06875 5C
- Impact of Oil Spillage from World War II Tanker Sinkings.
W77-06877 5C
- WATER POLLUTION SOURCES**
- The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment.
W77-06629 5C
- Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton.
W77-06637 5C
- The Fauna of the Polluted River Tees Estuary.
W77-06638 5C
- Petroleum Hydrocarbons from Effluents: Detection in Marine Environment.
W77-06660 5A
- An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3).
W77-06668 5B
- Study of Leachate at Landfill Sites 1975, Volume 1.
W77-06851 5B
- Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments.
W77-06899 5C
- Phosphate Prediction Model for Streams by Means of Discriminant Analysis.
W77-06906 5B
- The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds.
W77-06909 5B
- Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields.
W77-06914 5B
- Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite.
W77-06975 5B
- Sediments and Water Quality of Urban Storm Water.
W77-06984 5B
- Chicago Drives Large Bores to Control Combined Sewage Flow.
W77-06988 8E
- Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent.
W77-07045 5A
- The WRE Storm Model.
W77-07073 5B

SUBJECT INDEX

WATER POLLUTION TREATMENT

WATER POLLUTION TREATMENT

The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F

WATER PURIFICATION

Renovation of Waste Water, W77-07004 5D

The Fabric-Lined Purification Basin, W77-07035 5D

Purifying Water, W77-07061 5D

Waste Water Reuse Practice in the United States, W77-07087 5D

WATER QUALITY

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay, W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A

Mineral Content of Selected Geothermal Waters, W77-06667 3E

Monitoring Groundwater Quality: Illustrative Examples, W77-06673 5A

Water Chemistry and Water Quality, W77-06778 5A

Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

Algal Supplement Enhancement of Static and Recirculating System, W77-06933 5C

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C

Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington, W77-06971 4A

Canwel Can Do, W77-06985 5D

Purifying Water, W77-07061 5D

Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72, W77-07076 5A

WATER QUALITY CONTROL

Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G

The New York Bight Project - 1975; Stony Brook, Long Island, New York, W77-06876 5G

Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B

Water Quality Management and the Distribution of Emission Rights by Sealed Tender Markets, W77-06976 5E

Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

Integrated Approach to Urban Waste Water Management, W77-07095 5D

WATER REQUIREMENTS

The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F

WATER RESOURCES

Methods for Control of the Regimes for Water Resources Systems, W77-06717 4A

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

La Science des Systemes dans la Planification des Ressources en Eau, W77-06736 6A

A Dynamic Multisector Programming Approach to Regional Water Resource Management, W77-06737 6A

Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G

Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C

Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington, W77-06971 4A

Water in the Palouse River Basin, Washington, W77-06978 4B

A Nonlinear Multilevel Transportation Model for Water Resource-Water Quality Management, W77-07096 5B

WATER RESOURCES DEVELOPMENT

Mathematical Models in Hydrology, W77-06708 2A

Indices of Water Restriction and Water Deficiency Tolerance, W77-06711 6A

The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A

WATER RESTRICTION INDICES

Indices of Water Restriction and Water Deficiency Tolerance, W77-06711 6A

WATER REUSE

State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D

Purifying Water, W77-07061 5D

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D

Waste Water Reuse Practice in the United States, W77-07087 5D

WATER SOFTENING

Septic Tank Study is Off and Running, W77-06859 5D

WATER STORAGE

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

WATER SUPPLY

Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A

Water in the Palouse River Basin, Washington, W77-06978 4B

WATER SUPPLY DEVELOPMENT

Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow, W77-06905 2F

WATER SYSTEMS

Methods for Control of the Regimes for Water Resources Systems, W77-06717 4A

WATER TABLE

Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch), W77-06681 2G

WATER TEMPERATURE

Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

SUBJECT INDEX

WISCONSIN

Mixing in Upper Layer of a Lake During Heating Cycle,
W77-06649 2H

Lake Currents and Temperatures Near the Western Shore of Lake Michigan,
W77-06687 2H

Fish Diseases and Parasites in Relation to the Environment,
W77-06744 5C

The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish),
W77-06750 5C

The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish),
W77-06753 5C

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish),
W77-06754 5C

Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish),
W77-06755 5C

The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish),
W77-06756 5C

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary,
W77-06910 5B

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969,
W77-06925 5C

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen,
W77-06960 7B

WATER TREATMENT

The Removal of Organic Matter from Water Supplies by Ion Exchange,
W77-06760 5F

WATER UTILIZATION

Land Forming Systems to Improve Water Use Efficiency,
W77-06761 3F

WATER WELL FIELD

Hydraulics and Economics of Well Field Layout,
W77-06863 8B

WATER WELLS

New Design Gives Denver District Iron-Free Well,
W77-06868 8A

WATER YIELD IMPROVEMENT

Place and Role of Plant Cover in Optimization of the Donbas Natural Environment, (In Ukrainian),
W77-06858 4C

WATERFOWL

Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska,
W77-06813 6G

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds,
W77-06820 6G

WATERSHED MANAGEMENT

Open Space and Urban Water Management - Phase II: Case Studies and Findings,
W77-06917 6B

Water in the Palouse River Basin, Washington,
W77-06978 4B

WATERTON LAKES (ALBERTA)

Limnological and Planktonic Studies in the Waterton Lakes, Alberta,
W77-06680 5C

WAVES (WATER)

A Study to Forecast the Waves at Digha,
W77-06648 2L

Observations of Wind-Generated Waves on Variable Current,
W77-06896 2L

WEATHER DATA

Forecasting Floods in Hawaii (Excluding Hawaii Island),
W77-06873 4A

WEATHER MODIFICATION

Weather Modification in the Soviet Union--1976,
W77-06644 3B

On the Status of Hail Suppression,
W77-06645 3B

Compressed Air for Supercooled Fog Dispersal,
W77-06674 3B

WEBER BASIN PROJECT (UTAH)

Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project,
W77-06739 6B

WELL CASINGS

Bits and Pieces,
W77-06866 8G

WELL CONSTRUCTION

The Legal Responsibility of Water Well Drillers,
W77-06862 5G

WELL CONTRACTOR LIABILITY

The Legal Responsibility of Water Well Drillers,
W77-06862 5G

WELL DESIGN

Submersible Pump Design: Dependent on Well Diameter and Depth,
W77-06867 8C

WELL REGULATIONS

The Legal Responsibility of Water Well Drillers,
W77-06862 5G

WELLS

Performance of a Recharge and Recovery System in an Aquifer with Uniform Flow,
W77-06905 2F

WESTERN UNITED STATES

Mineral Content of Selected Geothermal Waters,
W77-06667 3E

WETLANDS

Hydraulics of Sheet Flow in Wetlands,
W77-06929 8B

WHEAT

Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian),
W77-06827 2I

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures,
W77-07079 5D

WILDLIFE

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian),
W77-06838 6G

WIND EROSION

Computing Eolian Sand Transport from Routine Weather Data,
W77-06669 2L

WIND-GENERATED WAVES

Observations of Wind-Generated Waves on Variable Current,
W77-06896 2L

WINDS

A Study to Forecast the Waves at Digha,
W77-06648 2L

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution,
W77-06697 5C

Observations of Wind-Generated Waves on Variable Current,
W77-06896 2L

Numerical Models of Wind-Driven Circulation in Lakes,
W77-06958 2H

WINNIPEG (CANADA)

The Chemical Characteristics of the City of Winnipeg Waste Water,
W77-07047 5A

WINTER

The Observed Winter Circulation of Lake Ontario,
W77-06655 2H

WINTER CIRCULATION

The Observed Winter Circulation of Lake Ontario,
W77-06655 2H

WIRE ROPE

Make Wire Rope Last-Treat it Like a Machine,
W77-06857 8G

WISCONSIN

A Device for Measuring Seepage Flux in Lakes and Estuaries,
W77-06903 7B

Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite,
W77-06975 5B

SUBJECT INDEX

WITHDRAWAL

WITHDRAWAL

Economic Analysis of Alternative Groundwater
Withdrawal Rates in Conjunction with Surface
Water Irrigation,
W77-06740 4B

Initial Zooplankton Investigations in Lower
Cook Inlet,
W77-06835 6G

WOOD WASTES

Land Application of Sewage Sludge: IV. Wheat
Growth, N Content, N Fertilizer Value, and N
Use Efficiency as Influenced by Sewage
Sludge and Wood Waste Mixtures,
W77-07079 5D

WORKABILITY

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

YUGOSLAVIA (DERDAP RESERVOIR)

Changes in the Structure of Phytoplankton
During the First Years of Existence of the
Derdap Storage Reservoir, (In Serbo-Croatian),
W77-06786 2H

ZINC

The Uptake of Lead, Zinc, Cadmium, and
Copper by the Pulmonate Mollusc, *Helix asper-*
sa Muller, and its Relevance to the Monitoring
of Heavy Metal Contamination of the Environ-
ment,
W77-06629 5C

The Toxic Effects of Selected Heavy Metals on
Unadapted Populations of *Vorticella Conval-*
laria Var *Similis*,
W77-06636 5C

ZOOGLOEA RAMIGERA

Some Factors Affecting Floc Formation by
Zoogloea Ramigera, Strain I-16-M,
W77-07042 5D

ZOOPLANKTON

Zooplankton Sampling Variability: Controlled
Ecosystem Pollution Experiment,
W77-06615 5A

Dynamics of Micro-Zooplankton Populations
Treated with Copper: Controlled Ecosystem
Pollution Experiment,
W77-06616 5A

Evaluation of Potential Indicators of Sub-
Lethal Toxic Stress on Marine Zooplankton
(Feeding, Fecundity, Respiration and Excre-
tion): Controlled Ecosystem Pollution Experi-
ment,
W77-06617 5A

Experimental Observations on the Effects of
Copper on Copepods and Other Zooplankton:
Controlled Ecosystem Pollution Experiment,
W77-06619 5A

Response of Macro-Zooplankton Populations
to Copper: Controlled Ecosystem Pollution Ex-
periment,
W77-06620 5A

Limnological and Planktonic Studies in the
Waterton Lakes, Alberta,
W77-06680 5C

A Study on the Role of Herbivorous Zooplank-
ton Community as Primary Consumers of
Phytoplankton in Dutch Lakes,
W77-06695 5C

Primary and Secondary Production of Plankton
in Heated Lakes, (In Polish),
W77-06752 5C

AUTHOR INDEX

- ADAR, Z.**
Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G
- AGBIM, N. N.**
Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures, W77-07079 5D
- ALEKSEEV, A. M.**
Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I
- ALLEN, J. S.**
Continental Shelf Waves and Alongshore Variations in Bottom Topography and Coastline, W77-06891 2L
- ALVARES DA SILVA, M. O. S.**
Stabilisation Lagoons Including Experience in Brazil. Part I, W77-07063 5D
- AMIARD, J. C.**
Effects of Various Ecological Factors on Radiostromium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostromium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.), W77-06777 5C
- ANDERSON, C.**
The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F
- ANDERSON, D. C.**
Contract Services Stretch Sewer Maintenance Budget, W77-06994 8G
- ANDERSON, D. W.**
Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G
Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G
- ANDERSON, R. S.**
Limnological and Planktonic Studies in the Waterton Lakes, Alberta, W77-06680 5C
- ANDREOLI, C.**
The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period, W77-06770 5C
- ANDREW, R. C.**
Underflow from Sludge-Irrigated Cropland, W77-07056 5B
- ANDREWS, W. H.**
Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project, W77-06739 6B
- ANDRONIKOV, V. B.**
Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C
- ANTHONY, R. S.**
Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J
- ARBOLEDA, J.**
Backwashing of Granular Filters, W77-07037 5D
- ARKHANGUELSKY, YU. A.**
Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A
- ARNESON, P. D.**
Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G
- ARONOVICH, T. M.**
Egg Incubation and Larval Rearing of Navaga (Eleginus Navaga Pall.), Polar Cod (Boreogadus Saida Lepechin) and Arctic Flounder (Liopsetta Glacialis Pall.) in the Laboratory, W77-06792 8I
- ARRHENIUS, E.**
Health Effects of Multipurpose Use of Water, W77-06775 5C
- ASKEW, A. J.**
Optimal Design and Operation of Reservoir Systems, W77-06721 4A
- ASMUSSEN, L. E.**
Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed, W77-06908 5B
- ATAEV, N. A.**
Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C
- ATANASIU, N.**
The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F
- ATTANASI, E. D.**
Water Quality Management and the Distribution of Emission Rights by Sealed Tender Markets, W77-06976 5E
- AULENBACH, D. B.**
Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G
- AZAM, F.**
Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A
Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A
- Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A
- AZARNOFF, D. L.**
Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent, W77-07045 5A
- BABCZYNSKI, S.**
Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D
- BAILLOD, C. R.**
Influence of Phosphorus Removal on Solids Budget, W77-07032 5D
- BAKER, D. G.**
Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B
- BALDINA, A. L.**
Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B
- BALL, J.**
Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B
- BARGMAN, R. D.**
Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D
- BARGUR, J.**
A Dynamic Multisector Programming Approach to Regional Water Resource Management, W77-06737 6A
- BARTLETT, S. F.**
Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G
- BARTOLOME, J. C.**
Modele Mathematique de Simulation du Systeme des Ressources Hydrauliques Superficielles du Llobregat, W77-06727 4A
- BARTON, L. H.**
Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G
- BARTONEK, J. C.**
Feeding Ecology and Trophic Relationships of Alaskan Marine Bird, and Population Dynamics of Marine Birds, W77-06819 6G
Migration of Birds in Alaska Coastal and Marine Habitats Subject to Influence by OCS Development, W77-06818 6G
Preliminary Catalog of Seabird Colonies and Photographic Mapping of Seabird Colonies, W77-06816 6G

AUTHOR INDEX

BARTONEK, J. C.

Review and Analysis of Literature and Unpublished Data on Marine Birds, W77-06817 6G

Seasonal Distribution and Abundance of Marine Birds, W77-06815 6G

BATEMAN, R. L.
Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

BATTAN, L. J.
Weather Modification in the Soviet Union--1976, W77-06644 3B

BAUMANN, E. R.
The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D

BAWEJA, A. S.
Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition, W77-06872 2G

BEARD, L. R.
Hydrological Evaluation of Changes in Runoff Characteristics, W77-06732 4A

BEAUPRE, R. T.
Influence of Phosphorus Removal on Solids Budget, W77-07032 5D

BECK, J.
Phosphates in Soils Treated with Sewage Water: II. Fractionation of Accumulated Phosphates, W77-07053 5B

BECKER, B. C.
An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

BEDFORD, W. K.
Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D

BEEK, J.
Phosphates in Soils Treated with Sewage Water: I. General Information on Sewage Farm, Soil, and Treatment Results, W77-07052 5G

Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds, W77-07054 5B

BEERS, J. R.
Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

BEININGEN, K. T.
Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

BELL, L. J.
Notes on the Nesting Success and Fecundity of the Anemonefish Amphiprion Clarkii at Miyake-Jima, Japan, W77-06763 5C

BENDA, R. S.
Growth and Movement of Fish in the Vicinity of a Thermal Discharge, W77-06766 5C

BENDOCK, T. M.
Beaufort Sea Estuarine Fishery Study, W77-06840 6G

BENEFIELD, L. D.
The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D

BEREGOVAYA, V. I.
Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

BERGER, A. R.
Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F

BERGMAN, D. L.
Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C

BERNDT, H. D.
Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

BERNER, R. A.
Interstitial Water Chemistry of Anoxic Long Island Sound Sediments. I. Dissolved Gases, W77-06900 5B

BERTNESS, M. D.
Temperature Relations of Puget Sound Thais in Reference to Their Intertidal Distribution, W77-06767 5C

BESCH, W. K.
A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

BESIK, F.
Renovation of Waste Water, W77-07004 5D

BETZ, J. M.
Fuel Gas and Electricity from Municipal Sewage, W77-07065 5D

BEUCHAT, L. R.
Environmental Factors Affecting Survival and Growth of Vibrio Parahaemolyticus. A Review, W77-06765 5C

BIERNACKI, T.
Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A

BILLARD, R.
Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C

BILLS, T. D.
Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

Toxicity of Rotenone to Fish in Standardized Laboratory Tests, W77-06748 5C

BLACKBURN, J. E.
Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

BLAIR, C. H.
Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L

BLEDSE, J. D.
Cost Comparison Between Subterranean and Current Tunneling Methods, W77-06662 8A

Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A

Cost Comparison Between Subterranean and Current Tunneling Methods, Appendix B--Subterranean Cost Analyses, W77-06664 8A

BLOOMFIELD, J. A.
A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C

BLOUGH, D.
Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D

BOISSEAU, D.
Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

BOLLER, M.
Process Technological Background Regarding New Protective Regulations of Water Bodies--Results of Nitrification and Phosphorus Elimination Experiments in Zurich and Bern. III. Filtration by Flocculation for the Elimination of Phosphorus from Communal Waste Water (Verfahrenstechnische Unterlagen im Hinblick auf die neuen Gewaesserschutzanforderungen-Ergebnisse der Versuche ueber die Nitrifikation und Phosphorelimination in Zurich und Bern. III. Flockungsfiltration zur Elimination von Phosphor aus Kommunalem Abwasser), W77-07082 5D

BOON, A. G.
The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

BOUCHE, G.
Effect of Two Rearing Conditions on Growth and Body Composition in Carp (Cyprinus Carpio L.), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C

AUTHOR INDEX

CHARLES, W. N.

- BOUCK, G. R.**
Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C
- BOVBJERG, R. V.**
Dispersal and Dispersion of Pond Snails in an Experimental Environment Varying to Three Factors, Singly and in Combination, W77-06773 5C
- BOWEN, J. H.**
Oxidation and Ozonation Chamber, W77-06999 5D
- BRADBURY, K. M.**
Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C
- BRADLEY, B. P.**
The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C
- BRADLEY, M. D.**
Environmental Impact Statements in Water Resources Planning and Decision Making, W77-06738 6E
- BRADLEY, R. M.**
Stabilisation Lagoons Including Experience in Brazil. Part I, W77-07063 5D
- BRAHAM, H. W.**
Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G
Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G
Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G
- BRAUNSCHEIDEL, D. E.**
UNOX System for Waste Water Treatment, W77-07014 5D
- BRETON, B.**
Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C
- BRINKMEIER, R.**
Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C
- BROAD, A. C.**
Reconnaissance Characterization of Littoral Biota, Beaufort and Chukchi Seas, W77-06843 6G
- BROWN, D. W.**
A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C
- BROWN, J. L.**
An Annular Flow Ice-Water Model Heat Sink, W77-06889 2C
- BRULAND, K. W.**
Monitoring the Marine Environment Through Sedimentation, W77-06651 2L
- BRUNNER, C. A.**
Waste Water Reuse Practice in the United States, W77-07087 5D
- BUCHANAN, J. M.**
Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply, W77-06700 5G
- BUCHHOLZ, J. R.**
Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B
- BUDHRAJA, V.**
The Conjunctive Use of a Multi-Reservoir System and a Dual-Purpose Desalting Plant, W77-06714 4B
- BUHLER, D. R.**
Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C
- BURAS, N.**
Integration of Aquifers in Flood Control Projects, W77-06723 4A
- BURNS, D. E.**
Backwashing of Granular Filters, W77-07037 5D
- BURNS, J. J.**
An Aerial Census of Spotted Seals, Phoca Vitulina Largha, W77-06800 6G
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatulus) and the Ringed Seal (Phoca (Pusa) Hispida), W77-06799 6G
- BURNS, J. R.**
Seasonal changes in the Respiration of Pumpkinseed, Lepomis Gibbosus, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C
- BURRESS, R. M.**
Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C
- BUTCHER, W. R.**
Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B
- BYKOV, V. N.**
Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B
- BYRNE, P.**
Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C
- CACHTER, R.**
Lake Restoration by Bottom Water Siphoning (In German), W77-06689 5G
- CALDWELL, R. S.**
Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C
- CAMBRAV, R. S.**
An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B
- CAMERON, J. J.**
Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D
- CAMP, B. J.**
Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in Ictalurus punctatus (Channel Catfish), W77-06759 5C
- CAMPBELL, B.**
Impact of Oil Spillage from World War II Tanker Sinkings, W77-06877 5C
- CAREY, J. H.**
Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E
- CARR, J. E.**
Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma, W77-06959 7C
- CARROLL, W. D.**
The Chemical Characteristics of the City of Winnipeg Waste Water, W77-07047 5A
- CATHCART, N. L.**
Automated Method for the Determination of the Phosphorus Content of Detergents, W77-06944 5A
- CEBULA, J.**
Composting of Sewage Sludge and Solid Waste Matter, W77-07084 5D
- CHANG, R. C-Y.**
Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A
- CHANG, W. Y. B.**
Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C
- CHANGNON, S. A. JR.**
On the Status of Hail Suppression, W77-06645 3B
- CHAPMAN, G. A.**
Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C
- CHARLES, W. N.**
A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction

AUTHOR INDEX

CHARLES, W. N.

- and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A
- CHASTAN-BAGNIS, L.
Device for Sucking the Upper Layer of a Polluted Water Surface, W77-07089 5G
- CHENG, R. T.
Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H
- CHEREMISINOFF, P. M.
Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D
- CHIAN, E. S. K.
Characterization of Soluble Organic Matter in Leachate, W77-07039 5A
- CHIANG, W. L.
Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F
- CHICHESTER, F. W.
The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B
- CHILDRESS, J. J.
Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*, W77-06642 5C
- CHMIELEWSKI, A. G.
Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D
- CHRISTENSEN, B. A.
Hydraulics of Sheet Flow in Wetlands, W77-06929 8B
- Incipient Sediment Motion in Entrances with Shell Beds, W77-06930 2L
- CIAMBRONE, D. F.
Ozone Oxidation of Waste Water, W77-07094 5D
- CICCONE, V. J.
Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2, W77-07077 5D
- CIRAVOLO, T. G.
Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B
- CLARK, A. B.
Agricultural Disposal of Aerobic Wastewater Sludges in an Urban County, W77-07057 5D
- CLEASBY, J. L.
Backwashing of Granular Filters, W77-07037 5D
- CLESCERI, L. S.
A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C
- CLESCERI, N. L.
Means for Protecting the Drinking Water Quality of Lake George, New York, W77-06682 5G
- Nutrient Removal and Sludge Disposal Within Septic Systems-Phase III, W77-06686 5D
- COLE, J. A.
Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A
- COLLIER, R. S.
Respiratory Response of Cunnners to Silver, W77-06789 5C
- COLLINS, E. R. JR.
Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B
- CONNORS, P. G.
Shorebird Dependence on Arctic Littoral Habitats, W77-06811 6G
- COON, R. F.
Cost Comparison Between Subterrene and Current Tunneling Methods, W77-06662 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A
- Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix B--Subterrene Cost Analyses, W77-06664 8A
- CORDES, E. H.
Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B
- COREY, R. B.
Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B
- CORNWELL, D. A.
Nutrient Removal by Water Hyacinths, W77-07036 5G
- Recycling of Aluminum Used for Phosphate Removal in Domestic Waste Water Treatment, W77-07099 5D
- CORY, R. L.
Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B
- COUGHTREY, P. J.
The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment, W77-06629 5C
- COX, J. H.
Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia, W77-06881 2L
- CRESSEY, G. M.
Influence of Phosphorus Removal on Solids Budget, W77-07032 5D
- CRILL, P. A.
Monitoring the Marine Environment Through Sedimentation, W77-06651 2L
- CROPPER, M. L.
Regulating Activities with Catastrophic Environmental Effects, W77-06703 6G
- CUENA, J.
Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A
- CUMMING, K. B.
Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C
- CUSTODIO, E.
Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A
- DAMKAER, D. M.
Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G
- DANCETTE, C.
A Method of Evaluating a Field Water Capacity Using PF-3, (In French), W77-06844 2G
- DARCY, K.
Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A
- DARR, R. E.
New Design Gives Denver District Iron-Free Well, W77-06868 8A
- DAS KAVIRAJ, S. K.
A Study to Forecast the Waves at Digha, W77-06648 2L
- DAUTOV, F. F.
Hygienic Effectiveness of Measures for Decontaminating Effluents at Petrochemical Plants, (In Russian), W77-07069 5D
- DAVIES, J. M.
Loch Ewe Bag Experiment, 1974, W77-06627 5A
- DAVIS, R. B.
The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes, W77-06741 5C
- DE HAAN, F. A. M.
Phosphates in Soils Treated with Sewage Water: I. General Information on Sewage Farm, Soil, and Treatment Results, W77-07052 5G

AUTHOR INDEX

FEDER, H. M.

- Phosphates in Soils Treated with Sewage Water: II. Fractionation of Accumulated Phosphates, W77-07053 5B
- DECKER, T. L.
New Design Gives Denver District Iron-Free Well, W77-06868 8A
- DELANEY, E. F.
New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G
- DEMONT, D. J.
First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C
- DEWALLE, F. B.
Characterization of Soluble Organic Matter in Leachate, W77-07039 5A
- DILLON, T. M.
Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H
- DIVOKY, G. J.
Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G
- DOMOKOS, M.
Indices of Water Restriction and Water Deficiency Tolerance, W77-06711 6A
- DOROSHEV, S. I.
Egg Incubation and Larval Rearing of Navaga (Eleginus Navaga Pall.), Polar Cod (Boreogadus Saida Lepechin) and Arctic Flounder (Liopsetta Glacialis Pall.) in the Laboratory, W77-06792 8I
- DOUNIN-BARKOVSKY, L. V.
Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A
- DROST, B. W.
Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington, W77-06971 4A
- DRURY, W. H.
Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska, W77-06813 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska, W77-06821 6G
- DUCKSTEIN, L.
Collective Utility: A Systems Approach to Water Pricing Policy, W77-06712 6C
- DUDKA, I. A.
Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I
- DUFFRIN, E.
Monitoring the Marine Environment Through Sedimentation, W77-06651 2L
- DYCK, S.
On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A
- EBEL, W. J.
Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C
- ECCLES, L. A.
USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G
- ECKHARDT, D. A. V.
Sediment Discharge from an Area of Highway Construction, Appleman Run Basin, Columbia County, Pennsylvania, W77-06969 4C
- EDWARDS, P.
Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C
- EIHE, E. P.
The Significance of Regulating the Water Regime of Agricultural Lands, (In Russian), W77-06837 3F
- EISELE, P. J.
The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C
- EJSMONT-KARABINOWA, J.
Primary and Secondary Production of Plankton in Heated Lakes, (In Polish), W77-06752 5C
- ELEUTERIUS, C. K.
Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B
- ELEY, T. J.
The Natural History and Ecology of the Bearded Seal (Erignathus Barbatulus) and the Ringed Seal (Phoca (Pusa) hispida), W77-06799 6G
- ELFERS, K.
Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B
- ELLENBERG, H.
Indicator Values of Vascular Plants in Central Europe, (In German), W77-06803 2I
- ELLIS, J. B.
Sediments and Water Quality of Urban Storm Water, W77-06984 5B
- ENGEL, P.
A Universal Calibration Equation for Price Meters and Similar Instruments, W77-06943 7B
- ENGLISH, T. S.
Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G
- EPITANIO, C.
Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C
- EPFLEY, R. W.
Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton, W77-06637 5C
- ERIKSSON, E.
Water Chemistry and Water Quality, W77-06778 5A
- EUGSTER, H. P.
Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K
- EVERITT, R. D.
Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G
- FAN, E.
Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D
- FARMER, D. M.
The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis, W77-06895 2L
- FARR, W. E.
Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C
- FARRELL, J. B.
Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D
- FAVORITE, F.
Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G
- FEDER, H. M.
The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

AUTHOR INDEX

FEDER, H. M.

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

FELDMAN, M.

Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B

FIELD, R.

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D

FILIMOWSKI, J.

The Out-of-Killer Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A

FILIPKOWSKI, A.

The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A

FISCHER, R. W.

Investigation of the Effects of Nonhomogeneous (or Nonstationary) Behavior on the Spectra of Atmospheric Turbulence, W77-06678 2B

FISCUS, C. H.

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

FLIEGEL, F. C.

Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G

FOESS, G. W.

Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D

FOLGER, D. W.

Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E

FORSTER, C. F.

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

FORSUND, F. R.

The Generation of Residual Flows in Norway: An Input-Output Approach, W77-06698 5G

FOSTIER, A.

Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la

Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C

FREY, D. G.

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

FURMAN, T. DES.

Nutrient Removal by Water Hyacinths, W77-07036 5G

GAMBLE, J. C.

Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment, W77-06619 5A

Loch Ewe Bag Experiment, 1974, W77-06627 5A

GAPPA, G.

Process for the Purification of Waste Waters with Activated Carbon, W77-07093 5D

GARCIA, L. L.

Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

GARDNER, R. A.

Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida, W77-06968 4B

GASS, T. E.

Electric Logging, W77-06865 8G

GATES, J. S.

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B

GIBSON, V. R.

Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A

GILDERHUS, P. A.

Field Tests of Isobornyl Thiocyanacetate (Thanite) for Live Collection of Fishes, W77-06747 5C

GLEASON, W. T.

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D

GLIBERT, P. M.

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

GLIWICZ, Z. M.

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

GODSHALL, F. A.

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

GOERING, J. J.

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

GRAHAM, M. J.

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations, W77-06982 5C

GRAY, J. S.

The Fauna of the Polluted River Tees Estuary, W77-06638 5C

GREEN, R. B.

Limnological and Planktonic Studies in the Waterton Lakes, Alberta, W77-06680 5C

GRETHLEIN, H. E.

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

GRICE, G. D.

Response of Macro-Zooplankton Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06620 5A

Zooplankton Sampling Variability: Controlled Ecosystem Pollution Experiment, W77-06615 5A

GRIFFIN, J. M.

Uncertainty and the Choice of Pollution Control Instruments, W77-06704 6G

GRIGOR'EV, YU. S.

Some Significant Regularities in Plant Hydroadaptation, (In Russian), W77-06774 3B

GRIN', N. V.

Experience in Treating Waste Waters from the Donetsk Mines, (In Russian), W77-07068 5D

GROVE, K.

Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico, W77-06632 5B

GRUNEWALD, U.

On the Application of Optimization Techniques to Conceptual Catchment Models, W77-06709 2A

GRUVER, G. W.

Optimal Investment in Pollution Control Capital in a Neoclassical Growth Context, W77-06705 6G

GUGGINO, E.

La Science des Systemes dans la Planification des Ressources en Eau, W77-06736 6A

GULATI, R. D.

A Study on the Role of Herbivorous Zooplankton Community as Primary Consumers of Phytoplankton in Dutch Lakes, W77-06695 5C

GUNN, G. A.

Fail-Safe Waste Treatment System, W77-07027 5D

AUTHOR INDEX

HILLBRICHT-ILKOWSKA, A.

- GUO, P. H. M.
Activated Sludge Treatment of High Strength
NSSC Mill Effluent,
W77-06945 5D
- State-of-the-Art Review of Processes for Treat-
ment and Reuse of Potato Wastes,
W77-06949 5D
- GUTHRIE, D. L.
Municipal Waste Water Treatment as an Indus-
trial Operation,
W77-07025 5D
- GUY, H. P.
Diminution Ratios for Planning Construction-
Area Sediment Controls,
W77-06980 4D
- GUYMON, G. L.
Suprapermafrost Water,
W77-06630 2C
- GUZMAN, J.
Ecology and Behavior of Southern Hemisphere
Shearwaters (Genus *Puffinus*) and Other
Seabirds, When Over the Outer Continental
Shelf of the Bering Sea and Gulf of Alaska
During the Northern Summer,
W77-06814 6G
- GYGER, R. G.
UNOX System for Waste Water Treatment,
W77-07014 5D
- HACKETT, J. E.
Design Study of Environmental and Human
Cultural Information System Needs in Urban
Water Resource Development,
W77-06634 6B
- HAKONSON, T. E.
Chemical Quality of Effluents and Their In-
fluence on Water Quality in a Shallow Aquifer,
W77-06658 5B
- HALDAR, B. C.
A Preliminary Survey of Mercury in Fish from
Bombay and Thana Environment,
W77-06785 5C
- HALL, A. J.
Mixing in Upper Layer of a Lake During Heat-
ing Cycle,
W77-06649 2H
- HALL, W. A.
Optimal Design and Operation of Reservoir
Systems,
W77-06721 4A
- HALLOCK, D. L.
Pollutant Movement to Shallow Ground Water
Tables from Swine Waste Lagoons,
W77-06742 5B
- HAMPSON, B. L.
Ammonia Concentration in Relation to Am-
monia Toxicity During a Rainbow Trout Rearing
Experiment in a Closed Freshwater-Sea-
water System,
W77-06743 5C
- HANCOCK, N.
Slipform Paver, Steel Forms Speed Lining of
25,000-Foot Sewer Tunnel,
W77-06992 8F
- HARAGUCHI, P.
Forecasting Floods in Hawaii (Excluding
Hawaii Island),
W77-06873 4A
- HARBO, S. J. JR.
An Aerial Census of Spotted Seals, *Phoca Vitu-
lina Largha*,
W77-06800 6G
- HARDING, JAMES L.
Sand Stabilization on the Dunes, Beach and
Shoreface of a Historically Eroding Barrier
Island. Wassaw Island Erosion Study, Part III,
W77-06940 8G
- HARDT, W. F.
USGS Scientists Bring California Water Supply
into Compliance with Federal Regulations,
W77-06853 5G
- HARRIS, C. K.
Assessment of Pelagic and Nearshore Fish in
Three Bays on Southeast Kodiak Island,
W77-06846 6G
- HARTFORD, J. D.
Adjustment Costs and Optimal Waste Treat-
ment,
W77-06699 5D
- HARTMANN, R.
Depth and Seasonal Fluctuations in the Con-
dition of the Groundwater of the Area Around
the City of Ghent (Belgium), (In Dutch),
W77-06681 2G
- HARTT, A. C.
Assessment of Pelagic and Nearshore Fish in
Three Bays on Southeast Kodiak Island,
W77-06846 6G
- HARTUNG, R.
The Effects of Methoxychlor on Riffle Inver-
tebrate Populations and Communities,
W77-06614 5C
- HASAN, S. M.
Integrated Approach to Urban Waste Water
Management,
W77-07095 5D
- HATTORI, A.
Effects of Copper on Silicic Acid Uptake by a
Marine Phytoplankton Population: Controlled
Ecosystem Pollution Experiment,
W77-06621 5A
- HAUG, R. T.
Anaerobic Filter Treats Waste Activated
Sludge,
W77-07078 5D
- HAUSER, E. W.
Loss of 2,4-D in Runoff from Plots Receiving
Simulated Rainfall and from a Small Agricul-
tural Watershed,
W77-06908 5B
- HECOCK, R. D.
A New Reservoir and Recreational Behavior,
W77-06956 6B
- HEESEN, T. C.
An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A
- HEGGIE, D. T.
Microbial Methane Consumption Reactions and
Their Effect on Methane Distributions in
Freshwater and Marine Environments,
W77-06899 5C
- HEINKE, G. W.
Plant Data Analysis of Temperature Sig-
nificance in the Activated Sludge Process,
W77-07046 5D
- HEISS, H. W.
The Legal Responsibility of Water Well Dril-
lers,
W77-06862 5G
- HEJTMANCIK, E.
Induction of Hepatic Microsomal Enzymes by
Aroclor 1254 in *Ictalurus punctatus* (Channel
Catfish),
W77-06759 5C
- HENDERSON, A. D.
Method of Applying Ozone and Sonic Energy
to Sterilize and Oxidize Waste Water,
W77-07007 5D
- HERNDON, J.
Testing and Grouting Leaking Joints,
W77-06986 8G
- HERRMANN, R.
Phosphate Prediction Model for Streams by
Means of Discriminant Analysis,
W77-06906 5B
- HERSHAFT, A.
The Plight and Promise of On-Site Waste Water
Treatment,
W77-07010 5D
- HERSHMAN, S.
Presenting Trends in Lake Eutrophication,
W77-06693 5C
- HESS, K.
Method of Treating Waste Water with Jet Noz-
zles,
W77-07090 5D
- HEUTMAKER, D. L.
Waste Injection into Stratified Ground Water
Bodies,
W77-06855 5B
- HICKS, J. R.
Compressed Air for Supercooled Fog Disper-
sal,
W77-06674 3B
- HIGNITE, C.
Drugs and Drug Metabolites as Environmental
Contaminants: Chlorophenoxyisobutyrate and
Salicylic Acid in Sewage Water Effluent,
W77-07045 5A
- HILL, D. W.
Induction of Hepatic Microsomal Enzymes by
Aroclor 1254 in *Ictalurus punctatus* (Channel
Catfish),
W77-06759 5C
- HILL, J. E.
Cost Comparison Between Subterranean and Cur-
rent Tunneling Methods,
W77-06662 8A
- Cost Comparison Between Subterranean and Cur-
rent Tunneling Methods, Appendix A--Baseline
Cost Analyses,
W77-06663 8A
- Cost Comparison Between Subterranean and Cur-
rent Tunneling Methods, Appendix B--Subter-
ranean Cost Analyses,
W77-06664 8A
- HILLBRICHT-ILKOWSKA, A.
Primary and Secondary Production of Plankton
in Heated Lakes, (In Polish),
W77-06752 5C

AUTHOR INDEX

HOCHMAN, E.

HOCHMAN, E.

Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G

HOCUTT, C. H.

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

HODGES, D. B.

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B

HODSON, R.

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

HODSON, R. E.

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment, W77-06623 5A

Response of Natural Marine Bacterial Populations to Copper: Controlled Ecosystem Pollution Experiment, W77-06622 5A

HOFFMAN, G. L.

Fish Diseases and Parasites in Relation to the Environment, W77-06744 5C

HOLLYDAY, E. F.

Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery, W77-06972 4A

HOLM-HANSEN, O.

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

HOOK, J. E.

Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B

HOPTON, F. J.

Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E

HORN, D.

Impact of Oil Spillage from World War II Tanker Sinkings, W77-06877 5C

HORNE, A. J.

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution, W77-06697 5C

HORNER, R. W.

London's Stormwater Problem, W77-06983 5D

HORNUNG, H.

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-06782 5C

HOSKINS, K. D.

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

HOUCK, C. P.

Subsurface Injection-How Much Does It Cost, W77-07011 5E

HOUGHTON, R. W.

Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling, W77-06893 2L

HRZYCYK, O.

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D

HSU, S. A.

Computing Eolian Sand Transport from Routine Weather Data, W77-06669 2L

HUANG, N. E.

Observations of Wind-Generated Waves on Variable Current, W77-06896 2L

HUFSCMIDT, M. M.

Open Space and Urban Water Management - Phase II: Case Studies and Findings, W77-06917 6B

HUNN, J. B.

Changes in the Blood Chemistry of Coho Salmon Exposed to Malachite Green, W77-06746 5C

HUNT, G. L. JR.

Reproductive Ecology of Pribilof Island Seabirds, W77-06809 6G

HUNTER, A. H.

Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization, W77-06870 3F

IKEDA, T.

Evaluation of Potential Indicators of Sub-Lethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment, W77-06617 5A

IONSON, A.

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

ITEM, H.

A Model for the Water Regime of a Deciduous Forest with Special Consideration of the Functional Interrelationships Among Meteorological Factors, Soil Water Content and Evapotranspiration, (In German), W77-06864 2A

JACOBY, S. L. S.

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A

JALABERT, B.

Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C

JAMES, D. W.

Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization, W77-06870 3F

JANK, B. E.

Activated Sludge Treatment of High Strength NSSC Mill Effluent, W77-06945 5D

JEDRYSIK, M.

General Description of the Vistula River Project and Basic Planning Data, W77-06733 4A

JEFFERIES, D. F.

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3), W77-06668 5B

JEFFERS, A.

NASA Develops Water Monitoring System, W77-06912 5A

JENKINS, R. G.

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

JERIS, J. S.

Apparatus and Process for Removing Ammonia Nitrogen from Waste Water, W77-07008 5D

Waste Treatment Apparatus, W77-07005 5D

Waste Treatment Process, W77-07091 5D

JEWSON, D. H.

Some Effects on Integral Photosynthesis of Artificial Circulation of Phytoplankton Through Light Gradients, W77-06696 5C

JOBSON, H. E.

Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

JONES, B. F.

Hydrochemistry of the Lake Magadi Basin, Kenya, W77-06967 2K

JONES, E. B. G.

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi, W77-06772 5C

JONES, J. G.

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

AUTHOR INDEX

KROGMAN, B. D.

- JONES, R. D. JR.**
Characterization of Coastal Habitat for Migratory Birds: Northern Bering Sea, W77-06824 6G
- JUNTGEN, H.**
Process for the Purification of Waste Waters with Activated Carbon, W77-07093 5D
- JUST, R. E.**
Two-Goal Regional Environmental Policy: The Case of the Santa Ana River Basin, W77-06707 5G
- KACZMAREK, Z.**
The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A
- KADDAH, M. T.**
Salinity Effects on Rice After the Boot Stage, W77-06871 3C
- KAISER, R. J.**
Razor Clam (*Siliqua Patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G
- KANIAS, G. D.**
Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A
- KARABIN, A.**
Primary and Secondary Production of Plankton in Heated Lakes, (In Polish), W77-06752 5C
- KARDOS, L. T.**
Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B
- KARLINGER, M. R.**
Surface Water Network Design by Regression Analysis Simulation, W77-06963 2E
- KARR, P. R. III.**
Factors Influencing the Dewatering Characteristics of Sludge, W77-07097 5D
- KECK, R.**
Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs, W77-06921 5C
- KEMBALL, A.**
A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C
- KERN, E.**
Impact of Oil Spillage from World War II Tanker Sinkings, W77-06877 5C
- KERR, R. L.**
Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B
- KHAN, M. A.**
Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C
- KIM, J. I.**
Nutrient Removal by Water Hyacinths, W77-07036 5G
- KIMBALL, B. A.**
Smoothing Data with Cubic Splines, W77-06831 7C
- KIMBALL, L. R.**
Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G
- KINDLER, J.**
The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A
- KING, I. P.**
The Out-of-Kilter Algorithm as a Single-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06735 4A
- KING, L. D.**
Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study, W77-07080 5D
- KING, P. H.**
The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D
- KISIEL, C. C.**
Collective Utility: A Systems Approach to Water Pricing Policy, W77-06712 6C
- KIVLIN, J. E.**
Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G
- KLEIN, J. M.**
USGS Scientists Bring California Water Supply into Compliance with Federal Regulations, W77-06853 5G
- KLING, S. A.**
Monitoring the Marine Environment Through Sedimentation, W77-06651 2L
- KNEBEL, H. J.**
Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon, W77-06966 2E
- KNIGHT, A. L.**
Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama, W77-06977 4C
- KNOWLES, C. E.**
Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina, W77-06654 2L
- KOELLER, P.**
The Growth of Young Salmonids (*Onchorhynchus Keta*): Controlled Ecosystem Pollution Experiment, W77-06618 5A
- KOELLIKER, J. K.**
Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F
- KOERNER, R. M.**
Devon Island Ice Cap: Core Stratigraphy and Paleoclimate, W77-06890 2C
- KOHLER, A.**
Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C
- KONIGSBERG, D.**
Razor Clam (*Siliqua Patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G
- KORNATOWSKI, T.**
The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A
- KORNEGAY, E. T.**
Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B
- KORNGOLD, U.**
Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A
- KOROBOVA, D. N.**
The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A
- KORYCKA, A.**
The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C
- KOSOGOROVA, T. A.**
Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B
- KOWAL, A. L.**
Renovated Water from Municipal Sewage Treatment Plants, W77-07086 5D
- KOWALIK, J. S.**
Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems, W77-06730 4A
- KRABACH, M. H.**
Evaluation of Alternative Solutions to Gas Bubble Disease Mortality of Menhaden at Pilgrim Nuclear Power Station, W77-06928 5G
- KRAJEWSKI, K.**
The Multi-Step Method for Simulation and Optimization of Vistula River Planning Alternatives, W77-06734 4A
- KROGMAN, B. D.**
Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

AUTHOR INDEX

KRUL, J. M.

KRUL, J. M.

Some Factors Affecting Floc Formation by
Zoogloea Ramigera, Strain I-16-M,
W77-07042 5D

KUNDU, P. K.

An Analysis of Inertial Oscillations Observed
Near Oregon Coast,
W77-06892 2L

KUO, C. Y.

Investigation of Flushing Time in the Lafayette
River, Norfolk, Virginia,
W77-06881 2L

LACROIX, G.

Nutrients, Chlorophyll, and Internal Tides in
the St. Lawrence Estuary,
W77-06910 5B

LAEVASTU, T.

Ecosystem Dynamics Birds and Marine Mam-
mals. Part III: A Dynamic Numerical Marine
Ecosystem Model for Evaluation of Marine
Resources in Eastern Bering Sea,
W77-06808 6G

LAIST, D.

Coastal Zone Management, Annotated Bibliog-
raphy,
W77-06937 2L

LAL, D.

Particulate Transport of Radionuclides ¹⁴C and
⁵⁵Fe to Deep Waters in the Pacific Ocean,
W77-06902 5B

LANGFORD, M.

The Use of Polymers for Improving Chemical
Sludge Dewatering on Sand Beds,
W77-07033 5D

LARKIN, E. P.

Persistence of Poliovirus 1 in Soil and on
Vegetables Grown in Soil Previously Flooded
with Inoculated Sewage Sludge or Effluent,
W77-07050 5C

LARRANCE, J. D.

Phytoplankton and Primary Productivity in the
Northeast Gulf of Alaska,
W77-06836 6G

LARSON, S. P.

Comparison of Iterative Methods of Solving
Two-Dimensional Groundwater Flow Equa-
tions,
W77-06965 2F

LASKI, A.

General Description of the Vistula River Pro-
ject and Basic Planning Data,
W77-06733 4A

LAWSON, T. J.

Zooplankton Sampling Variability: Controlled
Ecosystem Pollution Experiment,
W77-06615 5A

LEE, B. H.

Time-Distribution of Storm Rainfall in Pennsyl-
vania,
W77-07022 2B

LEE, D. R.

A Device for Measuring Seepage Flux in Lakes
and Estuaries,
W77-06903 7B

LEE, P. C.

The Chemical Characteristics of the City of
Winnipeg Waste Water,
W77-07047 5A

LEE, R. F.

Effects of Four Oils on Marine Bacterial Popu-
lations: Controlled Ecosystem Pollution Ex-
periment,
W77-06623 5A

LEENHEER, J. A.

Determination of Free Formic and Acetic
Acids by Gas Chromatography Using the
Flame Ionization Detector,
W77-06961 5A

LEHMAN, W. F.

Salinity Effects on Rice After the Boot Stage,
W77-06871 3C

LEICH, H. H.

Canwel Can Do,
W77-06985 5D

LENSINK, C. J.

Characterization of Coastal Habitat for Migra-
tory Birds: Northern Bering Sea,
W77-06824 6G

Feeding Ecology and Trophic Relationships of
Alaskan Marine Bird, and Population Dynamics
of Marine Birds,
W77-06819 6G

Migration of Birds in Alaska Coastal and
Marine Habitats Subject to Influence by OCS
Development,
W77-06818 6G

Preliminary Catalog of Seabird Colonies and
Photographic Mapping of Seabird Colonies,
W77-06816 6G

Review and Analysis of Literature and Un-
published Data on Marine Birds,
W77-06817 6G

Seasonal Distribution and Abundance of
Marine Birds,
W77-06815 6G

LEPORE, G.

Effluent Charges and Pollution Control: A Case
Study,
W77-06701 5G

LESHT, B.

A Self-Contained Facility for Analyzing Near-
Bottom Flow and Associated Sediment Trans-
port,
W77-06874 2L

LESZCZYNSKI, L.

The Influence of Effluent Heated Waters on
the Bottom Fauna of Lakes in the Vicinity of
Konin I. Quantitative Relations and Qualitative
Composition of the Bottom Fauna of the Konin
Lakes Complex, (In Polish),
W77-06749 5C

The Influence of Effluent Heated Waters on
the Bottom Fauna of Lakes in the Vicinity of
Konin II. Changes in Time of Bottom Fauna,
(In Polish),
W77-06750 5C

The Influence of Effluent Heated Waters on
the Bottom Fauna of Lakes in the Vicinity of
Konin III. An Effort to Explain the Causes and
Results of Changes in the Bottom Fauna of
Lakes as Influenced by the Inflow of Heated
Waters, (In Polish),
W77-06751 5C

LEVINE, M. D.

Energy Development: The Environmental
Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

LEVY, E. M.

High Seas Oil Pollution: Particulate Petroleum
Residues in the North Atlantic,
W77-06911 5B

LEYSHON, A. J.

Application of Municipal Refuse and Liquid
Sewage Sludge to Agricultural Land: II.
Lysimeter Study,
W77-07080 5D

LIKHOVOZ, L. K.

Optic Device for Observations of Small Organ-
isms Under Water, (In Russian),
W77-06926 7B

LIN, K.-C.

Plant Data Analysis of Temperature Sig-
nificance in the Activated Sludge Process,
W77-07046 5D

LINDAHL, P. E.

Rotary-Flow Technique for Testing Fitness of
Fish,
W77-06608 5C

LINDSAY, M. G.

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area,
Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G

Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Powder Drainage Basin,
W77-06604 2G

LINDSAY, R. C.

Identity, Origin and Development of Off-
Flavors in Great Lakes Anadromous Fish,
W77-06931 5A

LINDSAY, W. L.

Solubility and Plant Uptake of Cadmium in
Soils Amended with Cadmium and Sewage
Sludge,
W77-07055 5B

LIPNOWSKI, I. F.

An Input-Output Analysis of Environmental
Preservation,
W77-06706 6G

LLOYD, B. J.

The Toxic Effects of Selected Heavy Metals on
Unadapted Populations of Vorticella Conval-
laria Var Similis,
W77-06636 5C

LOCKWARD, G. M.

Expansion Comes Quickly to AWT Plant,
W77-07009 5D

LODER, T. C.

Blank and Salinity Corrections for Automated
Nutrient Analysis of Estuarine and Sea Waters,
W77-06938 5A

AUTHOR INDEX

MEHTA, A. J.

- LONG, I. F.**
Profiles and Evaporation,
W77-06898 2D
- LONG, S. R.**
Observations of Wind-Generated Waves on
Variable Current,
W77-06896 2L
- LOVELL, B. B.**
Oregon's Long Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Malheur River Drainage Basin,
W77-06605 2G
- Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Areas,
Owyhee Drainage Basin,
W77-06606 2G
- LOWE, P. R.**
An Approximating Polynomial for the Compu-
tation of Saturation Vapor Pressure,
W77-06652 2B
- MACDONALD, L. P.**
Burning Waste Chlorinated Hydrocarbons in a
Cement Kiln,
W77-06946 5E
- MACLEOD, W. D.**
A Pilot Study on the Design of a Petroleum
Hydrocarbon Baseline Investigation for
Northern Puget Sound and Strait of Juan de
Fuca,
W77-06875 5C
- MADDOX, M. B.**
Algal Supplement Enhancement of Static and
Recirculating System,
W77-06933 5C
- MADSEN, G. E.**
Improvement of Planning for Post-Develop-
ment Water Resource Management: A Study of
the Weber Basin Project,
W77-06739 6B
- MAERTENS, C.**
A Method of Evaluating a Field Water Capacity
Using PF-3, (In French),
W77-06844 2G
- MAIBORODA, I. I.**
Experience in Treating Waste Waters from the
Donetsk Mines, (In Russian),
W77-07068 5D
- MAIER, J.**
The Removal of Organic Matter from Water
Supplies by Ion Exchange,
W77-06760 5F
- MAKHOTIN, V. M.**
Egg Incubation and Larval Rearing of Navaga
(Eleginus Navaga Pall.), Polar Cod
(Boreogadus Saida Lepechin) and Arctic
Flounder (Liopsetta Glacialis Pall.) in the
Laboratory,
W77-06792 8I
- MALDONADO, A.**
Nile Conc: Late Quaternary Stratigraphy and
Sediment Dispersal,
W77-06650 2I.
- MALO, B. A.**
Partial Extraction of Metals from Aquatic Sedi-
ments,
W77-06781 5A
- MALOUF, R.**
Occurrence of Gas-Bubble Disease in Three
Species of Bivalve Molluscs,
W77-06921 5C
- MANIAK, U.**
Optimal Operations of Reservoirs in the Harz
Mountains,
W77-06715 4A
- MANNER, H. W.**
LAS Inhibition of Diffusion and Uptake of
Tritiated Uridine During Teleost Embryogene-
sis,
W77-06611 5C
- MANZI, J. J.**
Algal Supplement Enhancement of Static and
Recirculating System,
W77-06933 5C
- MARCELLO, R. A. JR.**
Evaluation of Alternative Solutions to Gas
Bubble Disease Mortality of Menhaden at Pil-
grim Nuclear Power Station,
W77-06928 5G
- MARK, W. D.**
Investigation of the Effects of Nonhomogene-
ous (or Nonstationary) Behavior on the Spectra
of Atmospheric Turbulence,
W77-06678 2B
- MARKING, L. L.**
Toxicity of Rotenone to Fish in Standardized
Laboratory Tests,
W77-06748 5C
- MARKSTORM, D. C.**
Land Application of Sewage Sludge: IV. Wheat
Growth, N Content, N Fertilizer Value, and N
Use Efficiency as Influenced by Sewage
Sludge and Wood Waste Mixtures,
W77-07079 5D
- MARTENS, C. S.**
Interstitial Water Chemistry of Anoxic Long
Island Sound Sediments. 1. Dissolved Gases,
W77-06900 5B
- MARTENS, D. C.**
Pollutant Movement to Shallow Ground Water
Tables from Swine Waste Lagoons,
W77-06742 5B
- MARTIN, M. H.**
The Uptake of Lead, Zinc, Cadmium, and
Copper by the Pulmonate Mollusc, *Helix asper-
sa* Muller, and its Relevance to the Monitoring
of Heavy Metal Contamination of the Environ-
ment,
W77-06629 5C
- MATTHEWS, D. G.**
Control Sewer Corrosion with H₂O₂,
W77-06993 8G
- MAURER, D.**
Occurrence of Gas-Bubble Disease in Three
Species of Bivalve Molluscs,
W77-06921 5C
- MAWER, P. A.**
Streamflow Regulation by Artificial Recharge
Fed from Upstream Surface Storage: Deriva-
tion of Control Rules,
W77-06725 4A
- MAY, B.**
A Preliminary Evaluation of the Effects of Gas
Bubble Disease on Fish Populations in the
Kootenai River Below Libby Dam,
W77-06919 5C
- MCALISTER, W. B.**
Ecosystem Dynamics Birds and Marine Mam-
mals. Part I: Preliminary Estimates of Pinniped
- Finfish Relationships in the Bering Sea,
W77-06806 6G
- Ecosystem Dynamics Birds and Marine Mam-
mals. Part III: A Dynamic Numerical Marine
Ecosystem Model for Evaluation of Marine
Resources in Eastern Bering Sea,
W77-06808 6G
- MCCAUGHEY, J. H.**
A Note on Temperature and Humidity Profile
Measurement Over Forests Using Diodes,
W77-06653 7B
- MCCULLOUGH, J. D.**
Electrically Powered Sampler for Benthic
Macroinvertebrates,
W77-06757 7B
- MCDANNALD, R. B.**
Bits and Pieces,
W77-06866 8G
- Pumping Systems: The Simpler, The Better,
W77-06856 8C
- MCDERMOTT, D. J.**
An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A
- MCKEON, J. B.**
Computer Mapping of Landsat Data for En-
vironmental Applications,
W77-06666 5A
- MCKIM, H. L.**
Use of Remote Sensing to Quantify Construc-
tion Material and to Define Geologic Linea-
tions; Dickey-Lincoln School Lakes Project,
Maine,
W77-06888 8D
- MCLEAN, E. O.**
Bonding of Calcium and Potassium by Ver-
miculite and Kaolinite Clays as Affected by H-
Clay Addition,
W77-06872 2G
- MCMILLAN, M. C.**
River Basin Snow Mapping at the National En-
vironmental Satellite Service,
W77-06915 2C
- MCNAUGHTON, K. G.**
Evaporation and Advection II: Evaporation
Downwind of a Boundary Separating Regions
Having Different Surface Resistances and
Available Energies,
W77-06897 2D
- MEDWIN, H.**
In Situ Acoustic Measurements of Microbub-
bles at Sea,
W77-06916 2L
- MEEK, B. D.**
Salinity Effects on Rice After the Boot Stage,
W77-06871 3C
- MEENAHAN, J. G.**
Evaluation of In-Line and Side-Line Flow
Equalization Systems,
W77-07041 5D
- MEHTA, A. J.**
Incipient Sediment Motion in Entrances with
Shell Beds,
W77-06930 2L

AUTHOR INDEX

MEHTA, A. J.

MERCER, J. W.

Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B

MERCER, R. W.

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

MERRELL, T. R. JR.

Baseline/Reconnaissance Characterization, Littoral Biot, Gulf of Alaska and Bering Sea, W77-06833 6G

MERRY, C. J.

Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine, W77-06888 8D

MEYER-WAARDEN, K.

A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C

MIGNONE, N. A.

Elimination of Anaerobic Digester Supernatant, W77-07059 5D

MILES, M. J.

Mineral Content of Selected Geothermal Waters, W77-06667 3E

MILLER, R. L.

A Self-Contained Facility for Analyzing Near-Bottom Flow and Associated Sediment Transport, W77-06874 2L

MILLER, R. W.

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station, W77-06922 5C

MILOVANOVIC, D.

Changes in the Structure of Phytoplankton During the First Years of Existence of the Derdap Storage Reservoir, (In Serbo-Croatian), W77-06786 2H

MIRZOEVI, G. G.

Escherichia Coli as a Sanitary-Indicator Microorganism, (In Russian), W77-07067 5A

MOBASHERI, F.

The Conjunctive Use of a Multi-Reservoir System and a Dual-Purpose Desalting Plant, W77-06714 4B

MONAN, G. E.

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

MORAITOPOULOU-KASSIMATI, E.

Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A

MORELOCK, D. J.

Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico, W77-06632 5B

MORGAN, N. W.

Hybrid Computer Analysis of a Combined Surface Water-Groundwater System, W77-06729 4B

MORGAN, W. S. G.

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

MORRIS, W. J.

Hybrid Computer Analysis of a Combined Surface Water-Groundwater System, W77-06729 4B

MORTIMER, C. H.

Lake Currents and Temperatures Near the Western Shore of Lake Michigan, W77-06687 2H

MOSES, H.

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B

MOSS, M. E.

Surface Water Network Design by Regression Analysis Simulation, W77-06963 2E

MUEHLEMAN, C.

LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

MURPHY, C. B. JR.

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows, W77-07031 5D

MURPHY, K. L.

The Current Role of Wastewater Disinfection, W77-07064 5D

MURRAY, S. P.

Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

MURRAY, T. D.

A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A

MYER, G. E.

Lake Ontario Atlas: Surface Waves, W77-06884 2H

MYSHLYAEVA, L. A.

Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

NAGEL, O.

Method of Treating Waste Water with Jet Nozzles, W77-07090 5D

NASSAR, E. G.

Water in the Palouse River Basin, Washington, W77-06978 4B

NAWROCKI, M. A.

An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G

NEELY, B. L. JR.

Floods in Louisiana, Magnitude and Frequency, Third Edition, W77-06979 2E

NELSON, D. W.

Forms of Sulfur in Sewage Sludge, W77-07044 5A

NELSON, M. O.

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

NEWCOMBE, S.

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

NHARITONOVA, N. N.

Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H

NICHOLAS, E. C.

Current Methods Used in the Soil Conservation Service to Estimate Sediment Yield, W77-06657 4D

NINTIN, S. A.

Causes of the Drying up of Forests in the Flood Plain of the Lower Reaches of the Ural River, (In Russian), W77-06801 4D

NORGREN, J. A.

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G

NORTON, S. A.

The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes, W77-06741 5C

NOVAK, A. F.

Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C

NOVAK, J. T.

The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D

NYBAKKEN, J.

Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C

AUTHOR INDEX

RAO, T. S.

- OERTEL, G. F.**
Characteristics of Water Flow at the North End of the Wassaw Barrier Island Complex. Wassaw Island Erosion Study, Part II, W77-06939 2J
- OERTEL, GEORGE F.**
Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island. Wassaw Island Erosion Study, Part III, W77-06940 8G
- OEZCUERUEMEZ, N.**
The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German), W77-06962 3F
- OLIVER, B. G.**
Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery, W77-07017 5E
- OLOFSSON, S.**
Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C
- ORR, B. R.**
Review and Analysis of Hydrogeologic Conditions Near the Site of a Potential Nuclear-Waste Repository, Eddy and Lea Counties, New Mexico, W77-06974 5B
- OSBORN, T. R.**
The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations, W77-06894 2L
- OSWALD, W. J.**
Method of Waste Treatment and Algae Recovery, W77-07003 5D
- PALLIO, F. S.**
Energy Conservation and Heat Recovery in Waste Water Treatment Plants, W77-07024 5D
- PAPADOPOULOU, C.**
Stable Elements of Radioecological Importance in Certain Echinoderm Species, W77-06640 5A
- PARENT, J. P.**
Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L.), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C
- PARK, R. A.**
A General Model of Microbial Growth and Decomposition in Aquatic Ecosystems, W77-06684 5C
- PARSONS, T. R.**
The Growth of Young Salmonids (*Onchorhynchus Keta*): Controlled Ecosystem Pollution Experiment, W77-06618 5A
- PATEL, J.**
Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A
- PATRINELY, C. D.**
Nutrient Removal by Water Hyacinths, W77-07036 5G
- PELOQUIN, A. E.**
Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D
- PENMAN, H. L.**
Profiles and Evaporation, W77-06898 2D
- PENTREATH, R. J.**
The Accumulation of Organic Mercury from Sea Water by the Plaice, *Pleuronectes platessa* L., W77-06607 5C
- PEREYRA, W. T.**
Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G
- PEREZ, M. A.**
Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped-Fish Relationships in the Bering Sea, W77-06806 6G
- PERIALE, J. M.**
Method of Applying Ozone and Sonic Energy to Sterilize and Oxidize Waste Water, W77-07007 5D
- PETERSON, F. L.**
Waste Injection into Stratified Ground Water Bodies, W77-06855 5B
- PEYTON, L. J.**
Avian Community Ecology of the Akulik - Inglutalik River Delta, Norton Bay, Alaska, W77-06822 6G
- PHINNEY, D. E.**
Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B
- PICKETT, R. L.**
The Observed Winter Circulation of Lake Ontario, W77-06655 2H
- PINCHUK, N. A.**
Antierosion Role of Forest Plantings in the Steppe Zone of the Moldavian SSR, (In Russian), W77-06745 4C
- PIWECKI, T.**
Optimization Model of a System of Two Open-Channel Hydroplants, W77-06716 4A
- PLUMMER, K. H.**
Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B
- POGGE, E. C.**
Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F
- POOLE, S. E.**
Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D
- POWELL, T. M.**
Numerical Models of Wind-Driven Circulation in Lakes, W77-06958 2H
- PRASAD, S. B. S. K.**
Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*, W77-06780 5C
- PRATISHTHANANDA, S.**
A Nonlinear Multilevel Transportation Model for Water Resource-Water Quality Management, W77-07096 5B
- PRENDIVILLE, P. W.**
Backwashing of Granular Filters, W77-07037 5D
- PULLEN, K. G.**
The Operations Section of Lincoln Sewage Division, W77-07023 5D
- PULLIN, J.**
Plug-In Concept for Pilot Sewage Treatment Plant, W77-07026 5D
- PURTYMUN, W. D.**
Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B
- QUINN, F. H.**
Lake St. Clair Hydrologic Transfer Factors, W77-06879 2H
- QUINN, W. F.**
An Annular Flow Ice-Water Model Heat Sink, W77-06889 2C
- QURESHI, A. A.**
Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique, W77-06942 5A
- QURESHI, A. S.**
Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A
- RACHFORD, T. M.**
Time-Distribution of Storm Rainfall in Pennsylvania, W77-07022 2B
- RAKSIT, S. K.**
Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D
- RANDALL, C. W.**
The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D
- RAO, M. S.**
Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*, W77-06780 5C
- RAO, R. M.**
Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C
- RAO, T. S.**
Median Tolerance Limits of Some Chemicals to the Fresh Water Fish *Cyprinus-Carpio*, W77-06780 5C

AUTHOR INDEX

RAO, T. S.

RASCIO, N.

The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period,
W77-06770 5C

RAYMOND, H. L.

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974),
W77-06927 5C

REDDY, S. J.

Simple Formulae for the Estimation of Wet Bulb Temperature and Precipitable Water,
W77-06646 2B

REEBURGH, W. S.

Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments,
W77-06899 5C

REED, L. E.

Computer Mapping of Landsat Data for Environmental Applications,
W77-06666 5A

REEVE, M. R.

Evaluation of Potential Indicators of Sublethal Toxic Stress on Marine Zooplankton (Feeding, Fecundity, Respiration and Excretion): Controlled Ecosystem Pollution Experiment,
W77-06617 5A

Experimental Observations on the Effects of Copper on Copepods and Other Zooplankton: Controlled Ecosystem Pollution Experiment,
W77-06619 5A

REICH, B. M.

Time-Distribution of Storm Rainfall in Pennsylvania,
W77-07022 2B

REICHENBERGER, J.

Process for the Purification of Waste Waters with Activated Carbon,
W77-07093 5D

RENGER, E. H.

Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton,
W77-06637 5C

RETTIG, S. L.

Hydrochemistry of the Lake Magadi Basin, Kenya,
W77-06967 2K

REYNOLDS, T. D.

Dispersion of Liquid Waste from a Moving Barge,
W77-06913 5B

REZNIKOVSKY, A. SH.

Methods for Control of the Regimes for Water Resources Systems,
W77-06717 4A

RISEBROUGH, R. W.

Shorebird Dependence on Arctic Littoral Habitats,
W77-06811 6G

RIVAS-MARTINEZ, S.

Ecological Data on Continental Aquatic Vegetation, (In Spanish),
W77-06784 2I

ROBERTS, H. H.

Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove,
W77-06904 2L

Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex,
W77-06677 2L

ROBERTS, S.

Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization,
W77-06870 3F

ROBERTSON, J. B.

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater,
W77-06981 5B

ROBINSON, F. E.

Salinity Effects on Rice After the Boot Stage,
W77-06871 3C

RODOSHKKEVICH, E. A.

Experience in Treating Waste Waters from the Donetsk Mines, (In Russian),
W77-07068 5D

ROGERS, P.

A Sector Model for Regional and National Water Resources Planning,
W77-06731 6A

ROGERS, R. H.

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay,
W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications,
W77-06666 5A

ROSENEAU, D. G.

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska,
W77-06823 6G

ROSS, R. G.

Adsorption, Coagulation and Filtration Make a Useful Treatment Combination-Part 2,
W77-07077 5D

ROTH, I.

Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel,
W77-06782 5C

ROZANOVA, E. P.

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian),
W77-07040 5B

RUCKER, R. R.

Gas Bubble Disease of Salmonids: A Critical Review,
W77-06920 5

RUHE, R. V.

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations,
W77-06982 5C

RUSSELL, S. O.

Presenting Trends in Lake Eutrophication,
W77-06693 5C

RYZNAR, E.

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems,
W77-06643 2B

SABEY, B. R.

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures,
W77-07079 5D

Solubility and Plant Uptake of Cadmium in Soils Amended with Cadmium and Sewage Sludge,
W77-07055 5B

SAHUQUILLO, A.

Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area,
W77-06728 4B

SALZMANN, H.

A Laboratory Study of Fluid and Soil Mechanics Processes During Hydraulic Dredging (Hydraulische und Bodentechnische Vorgänge beim Grundsaugen),
W77-06883 8D

SANDERS, J. W.

Mineral Content of Selected Geothermal Waters,
W77-06667 3E

SANGER, G. A.

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report),
W77-06807 6G

SARIN, R. K.

Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills,
W77-06702 5G

SARKAR, S. K.

A Study to Forecast the Waves at Digha,
W77-06648 2L

SARTORY, D. P.

The Toxic Effects of Selected Heavy Metals on Unadapted Populations of Vorticella Convalaria Var Similis,
W77-06636 5C

SATO, G. K.

Lake Currents and Temperatures Near the Western Shore of Lake Michigan,
W77-06687 2H

SAVAGE, E. S.

Backwashing of Granular Filters,
W77-07037 5D

SCHAMEL, D.

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds,
W77-06820 6G

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska,
W77-06812 6G

AUTHOR INDEX

SOLOV'EV, V. I.

- SCHARF, B.**
A Biological Monitoring System Employing Rheotaxis of Fish, W77-06609 5C
- SCHAUFFLER, F. K.**
Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D
- SCHecter, R. N.**
Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A
- SCHERER, C. R.**
Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills, W77-06702 5G
- SCHMIDT, N. F.**
Computer Mapping of Landsat Data for Environmental Applications, W77-06666 5A
- SCHNEIDER, D. E.**
Temperature Relations of Puget Sound Thais in Reference to Their Intertidal Distribution, W77-06767 5C
- SCHNEIDER, P. W. JR**
Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (*Oncorhynchus Nerka*), W77-06924 5C
- SCHNEIDER, S. R.**
River Basin Snow Mapping at the National Environmental Satellite Service, W77-06915 2C
- SCHULZ-BALDES, M.**
Long-Term Lead Accumulation in Abalone (*Haliotis* Spp.) Fed on Lead-Treated Brown Algae (*Egrella laevigata*), W77-06776 5C
- SCHWANBOM, E.**
Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C
- SEELIGER, U.**
Correlation Coefficients and Concentration Factors of Copper and Lead in Seawater and Benthic Algae, W77-06783 5C
- SEIBERT, D. L. R.**
Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A
- SEIDEL, K.**
On the Self-Purification of Natural Waters, (In German), W77-07038 5G
- SELECKI, A.**
Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis), W77-07048 5D
- SERFATY, A.**
Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L.), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C
- SHARAF EL DIN, S. H.**
Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast, W77-06907 2L
- SHARMA, N. C.**
Environmental Pollution: Is There Enough Public Concern to Lead to Action, W77-06955 6G
- SHARP, J. V. A.**
Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B
- SHERRILL, M. G.**
Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite, W77-06975 5B
- SHIELDS, G. F.**
Avian Community Ecology of the Akulik - In-glutalik River Delta, Norton Bay, Alaska, W77-06822 6G
- SHISHKINA, L. A.**
Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I
- SHIPET, G. I.**
Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H
- SHUBINSKI, R. F.**
Introduction to Urban Storm Water Runoff Models, W77-07071 5B
- SHUBINSKI, R. P.**
Simplified Methods of Computing the Quantity of Urban Runoff, W77-07072 5B
- The WRE Storm Model, W77-07073 5B
- SIDLE, R. C.**
Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation, W77-07049 5B
- SIEBERT, D. L. R.**
Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A
- SIKORA, L. J.**
Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B
- SILVA, L. F.**
A Study of the Utilization of EREP Data from the Wabash River Basin, W77-06670 7B
- SIMONSON, G. H.**
Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin, W77-06603 2G
- Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin, W77-06605 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin, W77-06606 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin, W77-06604 2G
- Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin, W77-06602 2G
- SINGER, J. J.**
Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina, W77-06654 2L
- SINN, R.**
Method of Treating Waste Water with Jet Nozzles, W77-07090 5D
- SITEK, G. M.**
An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control, W77-06671 5G
- SKELLETT, C. F.**
The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D
- SKIDMORE, J.**
Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F
- SKINNER, D. J.**
Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E
- SMITH, D. W.**
Annotated Bibliography on Northern Environmental Engineering 1974-75, W77-06948 5D
- SMITH, G. W.**
Clarifier with Overflow Scum Removal, W77-07092 5D
- SMITH, J. L.**
Subsurface Injection-How Much Does It Cost, W77-07011 5E
- SMITH, R. L.**
Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G
- SMYSER, S.**
New Visibility for On-Site Waste Treatment Systems, W77-07013 5D
- SOLOMON, S. I.**
Use of a Parametric Model as a Tool for Hydrometric Network Planning, W77-06710 2A
- SOLOV'EV, V. I.**
Experience in Treating Waste Waters from the Donetsk Mines, (In Russian), W77-07068 5D

AUTHOR INDEX

SOMAYAJULU, B. L. K.

SOMAYAJULU, B. L. K.

Particulate Transport of Radionuclides 14C and 55Fe to Deep Waters in the Pacific Ocean, W77-06902 5B

SOMMERS, L. E.

Forms of Sulfur in Sewage Sludge, W77-07044 5A

SOSZKA, G. J.

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

SOUTAR, A.

Monitoring the Marine Environment Through Sedimentation, W77-06651 2L

SPECTOROVA, L. V.

Egg Incubation and Larval Rearing of Navaga (Eleginus Navaga Pall.), Polar Cod (Boreogadus Saida Lepechin) and Arctic Flounder (Liopsetta Glacialis Pall.) in the Laboratory, W77-06792 8I

SPRINGER, A. M.

A Comparative Sea-Cliff Bird Inventory of the Cape Thompson Vicinity, Alaska, W77-06823 6G

STANCZYKOWSKA, A.

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish), W77-06754 5C

STANLEY, D. J.

Nile Cone: Late Quaternary Stratigraphy and Sediment Dispersal, W77-06650 2L

STANLEY, W. D.

Hydrologic Interpretation of Geophysical Data from the Southeastern Hueco Bolson, El Paso and Hudspeth Counties, Texas, W77-06970 4B

STARZECKA, A.

The Influence of Acrolein and Hydrocrole on the Development Dynamics of Aquatic Bacteria, W77-06690 5C

STAUFFER, J. R.

Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania, W77-06635 2I

STEELE, J. H.

Loch Ewe Bag Experiment, 1974, W77-06627 5A

STEELE, R. V.

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers, W77-06957 6G

STEPHENSON, J. P.

State-of-the-Art Review of Processes for Treatment and Reuse of Potato Wastes, W77-06949 5D

STEPHENSON, M.

Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C

STERBETZ, I.

The Mammalian and Fish Fauna of the Nature Preserve of Martely, (In Hungarian), W77-06838 6G

STEVENS, D. L.

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka), W77-06924 5C

STEWART, G. L.

Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment, W77-06616 5A

STEWART, J.

Long-Term Lead Accumulation in Abalone (Haliotis Spp.) Fed on Lead-Treated Brown Algae (Egregia Laevigata), W77-06776 5C

STICKEL, R.

Method of Treating Waste Water with Jet Nozzles, W77-07090 5D

STOKES, R. M.

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri), W77-06639 5C

STOW, D. A. V.

Preliminary Bibliography on Groundwater in Developing Countries, W77-06852 2F

STREET, J. J.

Solubility and Plant Uptake of Cadmium in Soils Amended with Cadmium and Sewage Sludge, W77-07055 5B

STROM, S.

The Generation of Residual Flows in Norway: An Input-Output Approach, W77-06698 5G

STURROCK, A. M. JR.

Comprehensive Monitoring of Meteorology, Hydraulics, and Thermal Regime of the San Diego Aqueduct, California, W77-06973 2D

SUHAYDA, J. N.

Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L

SULLIVAN, J. A.

Sewerage for a Rural Resort Area, W77-06987 5D

SULLIVAN, R.

Persistence of Poliovirus 1 in Soil and on Vegetables Grown in Soil Previously Flooded with Inoculated Sewage Sludge or Effluent, W77-07050 5C

SVENSON, G.

Waste Water Treatment Plant Built in Wet Hole, W77-07021 5D

SYLVESTER, A. J.

Laboratory Studies on the Effect of Metals on Oxygen Uptake by Sewage Sludge in Brackish Water, W77-06788 5C

SYMADER, W.

Phosphate Prediction Model for Streams by Means of Discriminant Analysis, W77-06906 5B

SZABO, M.

Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B

TABATABAI, M. A.

Forms of Sulfur in Sewage Sludge, W77-07044 5A

TAKAHASHI, M.

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment, W77-06626 5A

TANACREDI, J. T.

Petroleum Hydrocarbons from Effluents: Detection in Marine Environment, W77-06660 5A

TATINCLAUX, J. C.

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C

TAYLOR, R. E.

NASA Develops Water Monitoring System, W77-06912 5A

TEJAM, B. M.

A Preliminary Survey of Mercury in Fish from Bombay and Thana Environment, W77-06785 5C

TENNANT, D. A.

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

TERJUNG, W. H.

Climatology for Geographers, W77-06659 2B

TERRIAULT, J.-C.

Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B

THOMAS, G. H.

Burning Waste Chlorinated Hydrocarbons in a Cement Kiln, W77-06946 5E

THOMAS, W. H.

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment, W77-06624 5A

THOMAS, W. N.

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment, W77-06625 5A

THORN, D. G.

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

THORPE, S. A.

Mixing in Upper Layer of a Lake During Heating Cycle, W77-06649 2H

AUTHOR INDEX

WEGLENSKA, T.

- THURBERG, F. P.**
Respiratory Response of Cunners to Silver,
W77-06789 5C
- TIEMER, K.**
On Large-Scale Simulation of Groundwater
Flow Systems,
W77-06713 4B
- TIERNEY, J. T.**
Persistence of Poliovirus 1 in Soil and on
Vegetables Grown in Soil Previously Flooded
with Inoculated Sewage Sludge or Effluent,
W77-07050 5C
- TKACHENKO, V. S.**
Place and Role of Plant Cover in Optimization
of the Donbas Natural Environment, (In
Ukrainian),
W77-06858 4C
- TOETZ, D. W.**
Measurements of Planktonic Biomass in a
Reservoir,
W77-06679 5A
- TOFAUTE, K.**
Sewage Aeration Impeller-With Automatic De-
icing and Anti-Clogging System,
W77-07001 5D
- TONONAKA, G. K.**
Effect of Atmospheric Gas Supersaturation
Caused by Dams on Salmon and Steelhead
Trout of the Snake and Columbia Rivers (A
Review of the Problem and the Progress
Toward a Solution, 1974),
W77-06927 5C
- TOPPING, G.**
An Estimate of the Input of Atmospheric Trace
Elements into the North Sea and the Clyde Sea
(1972-3),
W77-06668 5B
- TORREST, R. S.**
Mixing and Circulation of Lakes and Reser-
voirs with Air Plumes,
W77-06633 5G
- TRACY, D.**
Avian Community Ecology at Two Sites on
Esenberg Peninsula in Kotzebue Sound,
Alaska. A Composite Study of: (1) Habitat
Utilization and Breeding Ecology of Water-
birds, (2) Habitat Utilization and Breeding
Ecology of Shorebirds and Nonwaterbird Spe-
cies, and (3) Habitat Utilization, Breeding
Ecology, and Feeding Ecology of Predators of
Birds,
W77-06820 6G
- TRAU, W.**
Optimal Operations of Reservoirs in the Harz
Mountains,
W77-06715 4A
- TRESCOTT, P. C.**
Comparison of Iterative Methods of Solving
Two-Dimensional Groundwater Flow Equa-
tions,
W77-06965 2F
- TRIPATHI, N.**
Area-Depth Relations for Frequency Values of
Rainfall,
W77-06647 2B
- TROEMPER, A. P.**
Underflow from Sludge-Irrigated Cropland,
W77-07056 5B
- TROTTA, P. D.**
On-Line Adaptive Control for Combined Sewer
Systems,
W77-07100 5D
- TULLOCK, G.**
Polluters' Profits and Political Response: Direct
Control Versus Taxes: Comments and Reply,
W77-06700 5G
- TURNBULL, J. W.**
Loss of 2,4-D in Runoff from Plots Receiving
Simulated Rainfall and from a Small Agricul-
tural Watershed,
W77-06908 5B
- TUWINER, S. B.**
Copper Sulfate Fights Root Growth in Sewer
Systems,
W77-06991 8G
- TWICHELL, D. C.**
Delaware River: Evidence for Its Former Ex-
tension to Wilmington Submarine Canyon,
W77-06966 2E
- URBAN, E.**
The Mining Fauna in Four Macrophyte Species
in Mikolajskie Lake,
W77-06688 5C
- VACCARO, R. F.**
Response of Natural Marine Bacterial Popu-
lations to Copper: Controlled Ecosystem Pollu-
tion Experiment,
W77-06622 5A
- VAN DEN AKKER, C.**
Performance of a Recharge and Recovery
System in an Aquifer with Uniform Flow,
W77-06905 2F
- VAN DEN BROEK, W. L. F.**
Heavy Metals in Macroinvertebrates and Fish
from the Lower Medway Estuary, Kent,
W77-06790 5C
- VAN GELDER, P.**
Design Criteria for Waste Water Aerator
Drives,
W77-07060 5D
- VAN RIEMSDIJK, W. H.**
Phosphates in Soils Treated with Sewage
Water: I. General Information on Sewage
Farm, Soil, and Treatment Results,
W77-07052 5G
- Phosphates in Soils Treated with Sewage
Water: II. Fractionation of Accumulated
Phosphates,
W77-07053 5B
- Phosphates in Soils Treated with Sewage
Water: III. Kinetic Studies on the Reaction of
Phosphates with Aluminum Compounds,
W77-07054 5B
- VANCE, H. M.**
Oregon's Long-Range Requirements for Water.
General Soil Map Report with Irrigable Area.
Grande Ronde Drainage Basin,
W77-06603 2G
- VANDENBERG, A.**
Tables and Type Curves for Analysis of Pump
Tests in Leaky Parallel-Channel Aquifers,
W77-06941 4B
- VELIKANOV, A. L.**
The Methods of Distribution of Water
Resources in River Development Systems,
W77-06726 4A
- VERKHOVSKII, B. S.**
Optimal Complex Use of Controlled Water
Resources of a Basin,
W77-06718 4A
- VERMEER, P. A.**
Performance of a Recharge and Recovery
System in an Aquifer with Uniform Flow,
W77-06905 2F
- VOLLRATH, H.**
Distribution and Indicatory Value of the Sub-
merged Macrophytes in the Flowing Waters of
the Friedberger Au, (In German),
W77-06802 5C
- WALDRON, K. D.**
Ichthyoplankton of the Eastern Bering Sea,
W77-06845 6G
- WALKER, J. I.**
A Note on Temperature and Humidity Profile
Measurement Over Forests Using Diodes,
W77-06653 7B
- WALTER, M. A.**
Evaluation of Potential Indicators of Sub-
lethal Toxic Stress on Marine Zooplankton
(Feeding, Fecundity, Respiration and Excre-
tion): Controlled Ecosystem Pollution Experi-
ment,
W77-06617 5A
- Experimental Observations on the Effects of
Copper on Copepods and Other Zooplankton:
Controlled Ecosystem Pollution Experiment,
W77-06619 5A
- WALTERS, K. L.**
Water in the Palouse River Basin, Washington,
W77-06978 4B
- WALTON, A.**
High Seas Oil Pollution: Particulate Petroleum
Residues in the North Atlantic,
W77-06911 5B
- WALTON, T. L. JR.**
Littoral Drift Estimates Along the Coastline of
Florida,
W77-06882 2L
- WANG, L. K.**
Adsorption, Coagulation and Filtration Make a
Useful Treatment Combination-Part 2,
W77-07077 5D
- WARE, G. C.**
Laboratory Studies on the Effect of Metals on
Oxygen Uptake by Sewage Sludge in Brackish
Water,
W77-06788 5C
- WEAVER, W. H.**
Potassium in an Arid Loessial Soil: Changes in
Availability as Related to Cropping and Fer-
tilization,
W77-06870 3F
- WEBBER, L. R.**
Application of Municipal Refuse and Liquid
Sewage Sludge to Agricultural Land: II.
Lysimeter Study,
W77-07080 5D
- WEGLENSKA, T.**
Primary and Secondary Production of Plankton
in Heated Lakes, (In Polish),
W77-06752 5C

AUTHOR INDEX

WEINSTEIN, A. I.

WEINSTEIN, A. I.

Compressed Air for Supercooled Fog Dispersal,
W77-06674 3B

WEISS, R. F.

The Solubility of Nitrogen, Oxygen and Argon in Water and Seawater,
W77-06923 5C

WEN, J.

Mixing and Circulation of Lakes and Reservoirs with Air Plumes,
W77-06633 5G

WENDEIN, M. F.

It's All on the Nameplate: Everything You Always Wanted to Know About Jet Pumps,
W77-06854 8C

WESTPHAL, A.

The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German),
W77-06962 3F

WESTPHAL, J. A.

Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I,
W77-07075 5B

WESTRATE, F. A.

Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds,
W77-07054 5B

WHARFE, J. R.

Heavy Metals in Macroinvertebrates and Fish from the Lower Medway Estuary, Kent,
W77-06790 5C

WHEATCRAFT, S. W.

Waste Injection into Stratified Ground Water Bodies,
W77-06855 5B

WHELAN, T. III.

Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex,
W77-06677 2L

WHITE, A. W. JR.

Loss of 2,4-D in Runoff from Plots Receiving Simulated Rainfall and from a Small Agricultural Watershed,
W77-06908 5B

WHITE, M. J. D.

Design and Control of Secondary Settlement Tanks,
W77-07015 5D

WHITE, R. V.

A Self-Contained Facility for Analyzing Near-Bottom Flow and Associated Sediment Transport,
W77-06874 2L

WHITE, W. R.

Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector,
W77-06961 5A

WHITNEY, F. A.

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment,
W77-06626 5A

WHITTLESEY, N. K.

Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation,
W77-06740 4B

WIENS, J. A.

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska,
W77-06810 6G

WIESNET, D. R.

River Basin Snow Mapping at the National Environmental Satellite Service,
W77-06915 2C

WILD, K.

Study on Sewage Flow Dynamics Through Dorr Type Clarifier on Stream, (Synopsis),
W77-07048 5D

WILLIAMS, D. C.

State Information Needs Related to Onshore and Nearshore Effects of OCS Petroleum Development,
W77-06934 6G

WILLIAMS, J. R.

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation,
W77-07006 5D

Sediment Yield Prediction Based on Watershed Hydrology,
W77-06656 4D

WILLIAMS, P. M.

Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton,
W77-06637 5C

WILLIAMS, S.

Electrically Powered Sampler for Benthic Macroinvertebrates,
W77-06757 7B

WOJCIECHOWSKA, W.

Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character,
W77-06685 5C

The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle,
W77-06692 5C

WOLAVER, T. G.

The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.: Theory and Quantitative Models,
W77-06675 2B

WOLMAN, M. G.

Changing Needs and Opportunities in the Sediment Field,
W77-06964 2J

WOLOTIRA, R. J. JR.

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea,
W77-06839 6G

WONG, G. G.

Anaerobic Filter Treats Waste Activated Sludge,
W77-07078 5D

WOOD, L. B.

London's Stormwater Problem,
W77-06983 5D

WOOD, R. B.

Some Effects on Integral Photosynthesis of Artificial Circulation of Phytoplankton Through Light Gradients,
W77-06696 5C

WRIGHT, D. A.

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta),
W77-06628 5C

WRIGHT, L. D.

Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry,
W77-06612 5C

WRIGLEY, R. C.

The Use of Remote Sensing to Detect How Wind Influences Planktonic Blue-Green Algal Distribution,
W77-06697 5C

WROE, L. R.

London's Stormwater Problem,
W77-06983 5D

WU, C. Y.

Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice,
W77-06661 2C

WYATT, T.

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules,
W77-06725 4A

YABROFF, I. W.

Energy Development: The Environmental Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

YATES, T.

Conditioning and Land Application of Aerobically Digested Sludge,
W77-07058 5D

YEH, W. W. G.

Optimal Design and Operation of Reservoir Systems,
W77-06721 4A

YOUNG, D. R.

An Offshore Biomonitoring System for Chlorinated Hydrocarbons,
W77-06641 5A

YOUNG, J. C.

The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories,
W77-07081 5D

ZAKREZEWSKI, J.

Effect of Water Work's Sludge on Waste Water Treatment,
W77-07085 5D

ZDANOWSKI, B.

The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish),
W77-06756 5C

The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish),
W77-06753 5C

Long-Term Changes of the Pelagic Primary
Production in Heated Lakes, (In Polish),
W77-06755 5C

Primary and Secondary Production of Plankton
in Heated Lakes, (In Polish),
W77-06752 5C

ZHUK, E. G.

Water Decontamination in Northern Regions
by Impulse Electric Charges, (In Russian),
W77-06791 5D

ZIELINSKI, J.

General Description of the Vistula River Pro-
ject and Basic Planning Data,
W77-06733 4A

ZILBERMAN, D.

Two-Goal Regional Environmental Policy: The
Case of the Santa Ana River Basin,
W77-06707 5G

ZIMMERMAN, S. T.

Baseline/Reconnaissance Characterization, Lit-
toral Biota, Gulf of Alaska and Bering Sea,
W77-06833 6G

ZOLTEK, J. JR.

Nutrient Removal by Water Hyacinths,
W77-07036 5G

ZOTOVA, V. I.

Quantitative Analysis of Enteroviruses in
Water with Various Degrees of Pollution, (In
Russian),
W77-07070 5A

ZWOLINSKI, K.

Study on Sewage Flow Dynamics Through
Dorr Type Clarifier on Stream, (Synopsis),
W77-07048 5D

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. BIOLOGICAL WASTE MANAGEMENT LAB.; AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL NITROGEN LAB.; AND AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. AGRICULTURAL ENVIRONMENTAL QUALITY INST.

Fate of Nitrogen and Phosphorus in Soils Under Septic Tank Waste Disposal Fields, W77-06914 5B

AGRICULTURAL RESEARCH SERVICE, BRAWLEY, CALIF. IMPERIAL VALLEY CONSERVATION RESEARCH CENTER.

Salinity Effects on Rice After the Boot Stage, W77-06871 3C

AGRICULTURAL RESEARCH SERVICE, COSHOCTON, OHIO. NORTH APPALACHIAN EXPERIMENTAL WATERSHED.

The Impact of Fertilizer Use and Crop Management on Nitrogen Content of Subsurface Water Draining from Upland Agricultural Watersheds, W77-06909 5B

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ. WATER CONSERVATION LAB.

Smoothing Data with Cubic Splines, W77-06831 7C

AGRICULTURAL RESEARCH SERVICE, TEMPLE, TEX.

Sediment Yield Prediction Based on Watershed Hydrology, W77-06656 4D

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS).

Phosphates in Soils Treated with Sewage Water: I. General Information on Sewage Farm, Soil, and Treatment Results, W77-07052 5G

Phosphates in Soils Treated with Sewage Water: II. Fractionation of Accumulated Phosphates, W77-07053 5B

Phosphates in Soils Treated with Sewage Water: III. Kinetic Studies on the Reaction of Phosphates with Aluminum Compounds, W77-07054 5B

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF MICROBIOLOGY.

Some Factors Affecting Floc Formation by Zoogloea Ramigera, Strain I-16-M, W77-07042 5D

AIR FORCE CAMBRIDGE RESEARCH LABS., L. G. HANSCOM FIELD, MASS. METEOROLOGY LAB.

Compressed Air for Supercooled Fog Dispersal, W77-06674 3B

AKADEMIYA NAUK SSSR, LENINGRAD. LAB. OF COMPARATIVE CYTOLOGY.

Heat Resistance of Gametes of Marine Invertebrates in Relation to Temperature Conditions Under Which the Species Exist, W77-06771 5C

AKADEMIYA NAUK SSSR, MOSCOW. CENTRAL ECONOMIC MATHEMATICAL INST.

Optimal Complex Use of Controlled Water Resources of a Basin, W77-06718 4A

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT MIKROBIOLOGII.

Biogenic Elements and Sulfate Reduction in Water Oil Carbonate Layer, (In Russian), W77-07040 5B

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT VODNYKH PROBLEM.

Mathematical Model of Water Resources Utilization in a River Basin, W77-06719 4A

The Methods of Distribution of Water Resources in River Development Systems, W77-06726 4A

AKADEMIYA NAUK URSR, KIEV. INSTYTUT BOTANIKI.

Foam and Film of Fresh Waters as an Ecological Niche of Aquatic Hyphomycetes, (In Russian), W77-06787 2I

AKADEMIYA NAUK URSR, KIEV. INSTYTUT BOTANIKI; AND AKADEMIYA NAUK URSR, KIEV. DEPT. OF GEOBOTANY AND PALEBOTANY.

Place and Role of Plant Cover in Optimization of the Donbas Natural Environment, (In Ukrainian), W77-06858 4C

ALABAMA UNIV., TUSCALOOSA.

Dispersion of Liquid Waste from a Moving Barge, W77-06913 5B

ALASKA DEPT. OF FISH AND GAME, ANCHORAGE. DIV. OF COMMERCIAL FISHERIES.

Spawning Herring Surveys in the Bering Sea and Finfish Resource Surveys in Norton Sound and Kotzebue Sound, W77-06828 6G

ALASKA DEPT. OF FISH AND GAME, FAIRBANKS.

The Natural History and Ecology of the Bearded Seal (*Erignathus barbatus*) and the Ringed Seal (*Phoca (Pusa) hispida*), W77-06799 6G

An Aerial Census of Spotted Seals, *Phoca Vitulina* Largha, W77-06800 6G

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska, W77-06804 6G

Identification, Documentation, and Delineation of Coastal Migratory Bird Habitat in Alaska, and the Distribution, Abundance and Feeding Ecology of Birds Associated with Pack Ice, W77-06805 6G

ALASKA DEPT. OF FISH AND GAME, FAIRBANKS. DIV. OF SPORT FISH.

Beaufort Sea Estuarine Fishery Study, W77-06840 6G

ALASKA DEPT. OF FISH AND GAME, KODIAK.

Pelagic and Demersal Fish Assessment in the Lower Cook Inlet Estuary System, W77-06829 6G

Demersal Fish and Shellfish Assessment in Selected Estuary Systems of Kodiak Island, W77-06847 6G

ALASKA DEPT. OF FISH AND GAME, KODIAK. DIV. OF COMMERCIAL FISHERIES.

Razor Clam (*Siliqua patula*, Dixon) Distribution and Population Assessment Study, W77-06830 6G

ALASKA UNIV., COLLEGE. INST. OF ARCTIC BIOLOGY.

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska. A Composite Study of: (1) Habitat Utilization and Breeding Ecology of Waterbirds, (2) Habitat Utilization and Breeding Ecology of Shorebirds and Nonwaterbird Species, and (3) Habitat Utilization, Breeding Ecology, and Feeding Ecology of Predators of Birds, W77-06820 6G

Avian Community Ecology of the Akulik - Inghalik River Delta, Norton Bay, Alaska, W77-06822 6G

ALASKA UNIV., COLLEGE. INST. OF MARINE SCIENCE.

Effects of Copper on Silicic Acid Uptake by a Marine Phytoplankton Population: Controlled Ecosystem Pollution Experiment, W77-06621 5A

Avifaunal Utilization of the Offshore Island Area Near Prudhoe Bay, Alaska, W77-06812 6G

The Distribution, Abundance, Diversity and Productivity of Benthic Organisms in the Bering Sea, W77-06826 6G

The Distribution, Abundance, Diversity, and Productivity of Benthic Organisms in the Gulf of Alaska, W77-06841 6G

Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and Bering Sea, W77-06842 6G

The Distribution, Abundance and Diversity of the Epifaunal Benthic Organisms in Two (Alitak and Ugak) Bays of Kodiak Island, Alaska, W77-06849 6G

Microbial Methane Consumption Reactions and Their Effect on Methane Distributions in Freshwater and Marine Environments, W77-06899 5C

ALASKA UNIV., COLLEGE. INST. OF WATER RESOURCES.

Suprapermafrost Water, W77-06630 2C

ALASKA UNIV., COLLEGE. O.C.S. COORDINATION OFFICE.

Technical Trawl Survey of the Benthic Epifauna of the Chukchi Sea and Norton Sound, W77-06848 6G

ORGANIZATIONAL INDEX

ALASKA UNIV., COLLEGE. O.C.S. COORDINATION OFFICE.

ALEXANDRIA LAKE AREA SANITARY DISTRICT, MINN.

Sewerage for a Rural Resort Area,
W77-06987 5D

ALEXANDRIA UNIV. (EGYPT). DEPT. OF OCEANOGRAPHY.

Effect of the Nile Flood on the Estuarine and Coastal Circulation Pattern Along the Mediterranean Egyptian Coast,
W77-06907 2L

ALL UNION RESEARCH INST. OF MARINE FISHERIES AND OCEANOGRAPHY, MOSCOW (USSR).

Egg Incubation and Larval Rearing of Navaga (Eleginus Navaga Pall.), Polar Cod (Boreogadus Saida Lepechin) and Arctic Flounder (Lopsetta Glacialis Pall.) in the Laboratory,
W77-06792 8I

ANDERSON-NICHOLS AND CO., INC., BOSTON, MASS.

Delineation of Flood Hazard Areas: Flood Hazard Report No. 2, Raritan River.
W77-06953 4A

ANDHRA UNIV., WALT AIR (INDIA). COLL. OF ENGINEERING.

Median Tolerance Limits of Some Chemicals to the Fresh Water Fish Cyprinus-Carpio,
W77-06780 5C

AQUINAS COLL., GRAND RAPIDS, MICH.

Growth and Movement of Fish in the Vicinity of a Thermal Discharge,
W77-06766 5C

ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.

Environmental Impact Statements in Water Resources Planning and Decision Making,
W77-06738 6E

ARIZONA UNIV., TUCSON. DEPT. OF SYSTEMS AND INDUSTRIAL ENGINEERING.

Collective Utility: A Systems Approach to Water Pricing Policy,
W77-06712 6C

ARIZONA UNIV., TUCSON. INST. OF ATMOSPHERIC PHYSICS.

Weather Modification in the Soviet Union--1976,
W77-06644 3B

ARMY ENGINEER DISTRICT, LOS ANGELES, CALIF.

Flood Hazard Information: Cave Creek, Arizona Canal to 19th Avenue, Phoenix, Arizona.
W77-06954 4A

ARMY ENGINEER DISTRICT, SEATTLE, WASH. SEATTLE DISTRICT.

A Preliminary Evaluation of the Effects of Gas Bubble Disease on Fish Populations in the Kootenai River Below Libby Dam,
W77-06919 5C

ASSOCIATION OF GEOSCIENTISTS FOR INTERNATIONAL DEVELOPMENT, ST. JOHN'S (NEWFOUNDLAND).

Preliminary Bibliography on Groundwater in Developing Countries,
W77-06852 2F

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND).

An Estimate of the Input of Atmospheric Trace Elements into the North Sea and the Clyde Sea (1972-3),
W77-06668 5B

BADEN-WUERTEMBERG LANDESANSTALT FUER UMWELTSCHUTZ (WEST GERMANY).

A Biological Monitoring System Employing Rheotaxis of Fish,
W77-06609 5C

BADISCHE ANILIN-UND SODA-FABRIK A.G., LUDWIGSHAFEN AM RHEIN (WEST GERMANY). LANDWIRTSCHAFTLICHE VERSUCHSSTATION. (ASSIGNEE).

Method of Treating Waste Water with Jet Nozzles,
W77-07090 5D

BAKER (MICHAEL), JR., INC., BEAVER, PA.

Evaluation of the Environmental Impact to Appalachian Pennsylvania Waters of the 1972 Flood and Subsequent Stream Channelization with Future Policy Recommendations.
W77-06676 4A

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.

Tissue Accumulation and Enzymatic Effects of Hexavalent Chromium in Rainbow Trout (Salmo Gairdneri),
W77-06639 5C

BDH, INC., ROME, GA. (ASSIGNEE).

Oxidation and Ozonation Chamber,
W77-06999 5D

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). ATLANTIC OCEANOGRAPHIC LAB.

High Seas Oil Pollution: Particulate Petroleum Residues in the North Atlantic,
W77-06911 5B

BENDIX AEROSPACE SYSTEMS DIV. ANN ARBOR, MICH.

Application of Landsat to the Surveillance and Control of Eutrophication in Saginaw Bay,
W77-06665 5A

Computer Mapping of Landsat Data for Environmental Applications,
W77-06666 5A

BERGBAU-FORSCHUNG G.M.B.H., ESSEN (WEST GERMANY).

Process for the Purification of Waste Waters with Activated Carbon,
W77-07093 5D

BLACK AND VEATCH, DENVER, COLO.

Subsurface Injection-How Much Does It Cost,
W77-07011 5E

BOEING AEROSPACE CO., SEATTLE, WASH.

NASA Develops Water Monitoring System,
W77-06912 5A

BOEING COMPUTER SERVICES INC., SEATTLE, WASH. MATHEMATICAL ANALYSIS UNIT.

Optimal Planning of Flows in Multi-Reservoir Hydro-Power Systems,
W77-06730 4A

BOLT BERANEK AND NEWMAN, INC., CAMBRIDGE, MASS.

Investigation of the Effects of Nonhomogeneous (or Nonstationary) Behavior on the Spectra of Atmospheric Turbulence,
W77-06678 2B

BRISTOL UNIV. (ENGLAND). DEPT. OF BACTERIOLOGY.

Laboratory Studies on the Effect of Metals on Oxygen Uptake by Sewage Sludge in Brackish Water,
W77-06788 5C

BRISTOL UNIV. (ENGLAND). DEPT. OF BOTANY.

The Uptake of Lead, Zinc, Cadmium, and Copper by the Pulmonate Mollusc, *Helix aspersa* Muller, and its Relevance to the Monitoring of Heavy Metal Contamination of the Environment,
W77-06629 5C

BRITISH COLUMBIA UNIV., VANCOUVER. INST. OF OCEANOGRAPHY.

The Growth of Young Salmonids (Onchorhynchus Keta): Controlled Ecosystem Pollution Experiment,
W77-06618 5A

Temperature, Salinity and Light Penetration Structures: Controlled Ecosystem Pollution Experiment,
W77-06626 5A

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part I. Observations,
W77-06894 2L

The Influence of Wind on the Surface Layer of a Stratified Inlet: Part II. Analysis,
W77-06895 2L

BUREAU OF SPORT FISHERIES AND WILDLIFE, SEATTLE, WASH. WESTERN FISH DISEASE LAB.

Gas Bubble Disease of Salmonids: A Critical Review,
W77-06920 5

BUREAU OF STUDIES AND DESIGNS FOR HYDRAULIC STRUCTURES, WARSAW (POLAND).

General Description of the Vistula River Project and Basic Planning Data,
W77-06733 4A

CALGARY UNIV., (ALBERTA).

Ecology and Behavior of Southern Hemisphere Shearwaters (Genus *Puffinus*) and Other Seabirds, When Over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska During the Northern Summer,
W77-06814 6G

CALIFORNIA UNIV., BERKELEY. (ASSIGNEE).

Method of Waste Treatment and Algae Recovery,
W77-07003 5D

CALIFORNIA UNIV., BODEGA BAY. BODEGA MARINE LAB.

Shorebird Dependence on Arctic Littoral Habitats,
W77-06811 6G

CALIFORNIA UNIV., IRVINE. DEPT. OF

ECOLOGY AND EVOLUTIONARY BIOLOGY. Reproductive Ecology of Pribilof Island Seabirds,
W77-06809 6G

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY.

Climatology for Geographers,
W77-06659 2B

ORGANIZATIONAL INDEX

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS

CALIFORNIA UNIV., LOS ANGELES. GRADUATE SCHOOL OF MANAGEMENT.
Optimal Oil Tanker Size with Regard to Environmental Impact of Oil Spills,
W77-06702 5G

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF ECONOMICS.
Regulating Activities with Catastrophic Environmental Effects,
W77-06703 6G

CALIFORNIA UNIV., SAN DIEGO, LA JOLLA. INST. OF MARINE RESOURCES.
Dynamics of Micro-Zooplankton Populations Treated with Copper: Controlled Ecosystem Pollution Experiment,
W77-06616 5A

Effects of Four Oils on Marine Bacterial Populations: Controlled Ecosystem Pollution Experiment,
W77-06623 5A

Effects of Copper on Phytoplankton Standing Crop and Productivity: Controlled Ecosystem Pollution Experiment,
W77-06624 5A

Effects of Copper on the Dominance and the Diversity of Algae: Controlled Ecosystem Pollution Experiment,
W77-06625 5A

Chlorine Reactions with Seawater Constituents and the Inhibition of Photosynthesis of Natural Marine Phytoplankton,
W77-06637 5C

CALIFORNIA UNIV., SANTA BARBARA. MARINE SCIENCE INST.
Effects of Pressure, Temperature and Oxygen on the Oxygen-Consumption Rate of the Mid-water Copepod *Gaussia Princeps*,
W77-06642 5C

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Adenosine Triphosphate (ATP) Levels in Microbial Cultures and a Review of the ATP Biomass Estimation Technique,
W77-06942 5A

A Universal Calibration Equation for Price Meters and Similar Instruments,
W77-06943 7B

Acid Solubilization of Sewage Sludge and Ash Constituents for Possible Recovery,
W77-07017 5E

CANADIAN BIO RESOURCES CONSULTANTS LTD., SURREY (BRITISH COLUMBIA).
Drying Potato Wastes for Animal Feed as an Alternative Disposal Method,
W77-06947 5D

CANADIAN WILDLIFE SERVICE, EDMONTON (ALBERTA).
Limnological and Planktonic Studies in the Waterton Lakes, Alberta,
W77-06680 5C

CATANIA UNIV. (ITALY). ISTITUTO DI IDRAULICA IDROLOGIA GESTIONE ACQUE (ITALY).
La Science des Systemes dans la Planification des Ressources en Eau,
W77-06736 6A

CBA ENGINEERING LTD., VANCOUVER (BRITISH COLUMBIA).
Presenting Trends in Lake Eutrophication,
W77-06693 5C

CEA CENTRE D'ETUDES NUCLEAIRES DE FONTENAY-AUX-ROSES (FRANCE). DEPARTEMENT DE PROTECTION.
Effects of Various Ecological Factors on Radiostrontium Uptake in Two Euryhaline Teleosts: Mugil Auratus Risso and Pleuronectes Platessal, (Influence de Divers Facteurs Ecologiques Sur L'Accumulation du Radiostrontium Chez Deux Teleosteens Euryhalins: Mugil Auratus Risso et Pleuronectes Platessa L.),
W77-06777 5C

CH2M/HILL, RESTON, VA.
Fail-Safe Waste Treatment System,
W77-07027 5D

CHERAW NATIONAL FISH HATCHERY, S. C.
Effect of Malachite Green and Formalin on the Survival of Largemouth Bass Eggs and Fry,
W77-06612 5C

CHICAGO UNIV., ILL. DEPT. OF THE GEOPHYSICAL SCIENCES.
A Self-Contained Facility for Analyzing Near-Bottom Flow and Associated Sediment Transport,
W77-06874 2L

CITY UNIV., LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Hybrid Computer Analysis of a Combined Surface Water-Groundwater System,
W77-06729 4B

CLEMSON UNIV., S. C.
Factors Influencing the Dewatering Characteristics of Sludge,
W77-07097 5D

CLERMONT COUNTY WATER AND SEWER DISTRICT, BATAVIA, OHIO.
Agricultural Disposal of Aerobic Wastewater Sludges in an Urban County,
W77-07057 5D

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H. EXPERIMENTAL ENGINEERING DIV.; AND COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H. NORTHERN ENGINEERING RESEARCH BRANCH.
An Annular Flow Ice-Water Model Heat Sink,
W77-06889 2C

COLD REGIONS RESEARCH AND ENGINEERING LAB. HANOVER, N.H. RESEARCH DIV.
Use of Remote Sensing to Quantify Construction Material and to Define Geologic Lineations; Dickey-Lincoln School Lakes Project, Maine,
W77-06888 8D

COLLEGE OF THE ATLANTIC, BAR HARBOR, MAINE.
Birds of Coastal Habitat on the South Shore of Seward Peninsula, Alaska,
W77-06813 6G

Studies of Populations, Community Structure and Colony of Marine Birds at King Island, Bering Strait Region, Alaska,
W77-06821 6G

COLOGNE UNIV. (WEST GERMANY). GEOGRAPHISCHES INSTITUT.
Phosphate Prediction Model for Streams by Means of Discriminant Analysis,
W77-06906 5B

COLORADO STATE UNIV., FORT COLLINS.
On-Line Adaptive Control for Combined Sewer Systems,
W77-07100 5D

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
Solubility and Plant Uptake of Cadmium in Soils Amended with Cadmium and Sewage Sludge,
W77-07055 5B

Land Application of Sewage Sludge: IV. Wheat Growth, N Content, N Fertilizer Value, and N Use Efficiency as Influenced by Sewage Sludge and Wood Waste Mixtures,
W77-07079 5D

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA).
Purifying Water,
W77-07061 5D

CONNELL/METCALF AND EDDY, CORAL GABLES, FLA.
Expansion Comes Quickly to AWT Plant,
W77-07009 5D

CORPUS CHRISTI PUBLIC UTILITIES, TEX.
Control Sewer Corrosion with H2O2,
W77-06993 8G

CUBIC CORP., SAN DIEGO, CALIF. (ASSIGNEE).
Ozone Oxidation of Waste Water,
W77-07094 5D

DELAWARE UNIV., LEWES. FIELD STATION.
Occurrence of Gas-Bubble Disease in Three Species of Bivalve Molluscs,
W77-06921 5C

DEMOCRITUS NUCLEAR RESEARCH CENTER, ATHENS (GREECE). CHEMISTRY DEPT.
Stable Elements of Radioecological Importance in Certain Echinoderm Species,
W77-06640 5A

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). POLAR CONTINENTAL SHELF PROJECT.
Devon Island Ice Cap: Core Stratigraphy and Paleoclimate,
W77-06890 2C

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, LINCOLN (NEW ZEALAND). CROP RESEARCH DIV.
Evaporation and Advection II: Evaporation Downwind of a Boundary Separating Regions Having Different Surface Resistances and Available Energies,
W77-06897 2D

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS DIRECTORATE.
Tables and Type Curves for Analysis of Pump Tests in Leaky Parallel-Channel Aquifers,
W77-06941 4B

ORGANIZATIONAL INDEX
DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). WASTEWATER TECHNOLOGY

**DEPARTMENT OF THE ENVIRONMENT,
OTTAWA (ONTARIO). WASTEWATER
TECHNOLOGY CENTRE.**

Activated Sludge Treatment of High Strength
NSSC Mill Effluent,
W77-06945 5D

State-of-the-Art Review of Processes for Treat-
ment and Reuse of Potato Wastes,
W77-06949 5D

Proceedings Technology Transfer Seminar on
Waste Handling, Disposal and Recovery in the
Metal Finishing Industry, November 12-13,
1975, Toronto, Ontario.
W77-06950 5D

**DEPARTMENT OF WASTE WATER
TECHNOLOGY AND SLUDGE DISPOSAL,
WARSAW (POLAND). LOCAL ECONOMY AND
ENVIRONMENT PROTECTION.**

Composting of Sewage Sludge and Solid Waste
Matter,
W77-07084 5D

**DONETSK MUNICIPAL SANITATION
EPIDEMIOLOGY STATION (USSR).**

Experience in Treating Waste Waters from the
Donetsk Mines, (In Russian),
W77-07068 5D

**ECOLOGOTROL, INC., BETHPAGE, N.Y.
(ASSIGNEE).**

Waste Treatment Apparatus,
W77-07005 5D

Apparatus and Process for Removing Ammonia
Nitrogen from Waste Water,
W77-07008 5D

Waste Treatment Process,
W77-07091 5D

**EIDGENOESSISCHE ANSTALT FÜR
WASSERVERSORGUNG,
ABWASSERREINIGUNG UND
GEWÄSSERSCHUTZ, ZÜRICH
(SWITZERLAND).**

A Model for the Water Regime of a Deciduous
Forest with Special Consideration of the Func-
tional Interrelationships Among Meteorological
Factors, Soil Water Content and Evapotrans-
piration, (In German),
W77-06864 2A

**EIDGENOESSISCHE ANSTALT FÜR
WASSERVERSORGUNG,
ABWASSERREINIGUNG UND
GEWÄSSERSCHUTZ, KASTENBAUM
(SWITZERLAND). MARINE RESEARCH LAB.**

Lake Restoration by Bottom Water Siphoning
(In German),
W77-06689 5G

ENVIREX, INC., MILWAUKEE, WIS.

Elimination of Anaerobic Digester Supernatant,
W77-07059 5D

**ENVIREX, INC., MILWAUKEE, WIS.
(ASSIGNEE).**

Clarifier with Overflow Scum Removal,
W77-07092 5D

**ENVIRONMENTAL PROTECTION SERVICE,
OTTAWA (ONTARIO).**

Annotated Bibliography on Northern Environ-
mental Engineering 1974-75,
W77-06948 5D

**ENVIRONMENTAL PROTECTION SERVICE,
OTTAWA (ONTARIO). CHEMISTRY LAB.**

Automated Method for the Determination of
the Phosphorus Content of Detergents,
W77-06944 5A

**ENVIRONMENTAL QUALITY SYSTEMS, INC.,
ROCKVILLE, MD.**

Municipal Waste Water Treatment as an Indus-
trial Operation,
W77-07025 5D

**FEDERAL WATER QUALITY
ADMINISTRATION, SAN FRANCISCO, CALIF.
PACIFIC SOUTHWEST REGIONAL OFFICE.**

Advanced Waste Treatment Seminar, Session
III, Removal of Solids and Organics, Held at
San Francisco, on October 28-29, 1970.
W77-07074 5D

**FISH AND WILDLIFE SERVICE,
ANCHORAGE, ALASKA. OFFICE OF
BIOLOGICAL SERVICES AND COASTAL
ECOSYSTEMS.**

Seasonal Distribution and Abundance of
Marine Birds,
W77-06815 6G

Preliminary Catalog of Seabird Colonies and
Photographic Mapping of Seabird Colonies,
W77-06816 6G

Review and Analysis of Literature and Un-
published Data on Marine Birds,
W77-06817 6G

Migration of Birds in Alaska Coastal and
Marine Habitats Subject to Influence by OCS
Development,
W77-06818 6G

Feeding Ecology and Trophic Relationships of
Alaskan Marine Bird, and Population Dynamics
of Marine Birds,
W77-06819 6G

Characterization of Coastal Habitat for Migra-
tory Birds: Northern Bering Sea,
W77-06824 6G

**FISH AND WILDLIFE SERVICE, LA CROSSE,
WIS. FISH CONTROL LAB.**

Changes in the Blood Chemistry of Coho Sal-
mon Exposed to Malachite Green,
W77-06746 5C

Toxicity of Rotenone to Fish in Standardized
Laboratory Tests,
W77-06748 5C

**FISH AND WILDLIFE SERVICE, WARM
SPRINGS, GA. SOUTHEASTERN FISH
CONTROL LAB.**

Field Tests of Isobornyl Thiocyanacetate
(Thanite) for Live Collection of Fishes,
W77-06747 5C

**FISH FARMING EXPERIMENTAL STATION,
STUTTGART, ARK.**

Fish Diseases and Parasites in Relation to the
Environment,
W77-06744 5C

FLORIDA UNIV., GAINESVILLE.

Integrated Approach to Urban Waste Water
Management,
W77-07095 5D

Recycling of Aluminum Used for Phosphate
Removal in Domestic Waste Water Treatment,
W77-07099 5D

**FLORIDA UNIV., GAINESVILLE. COASTAL
AND OCEANOGRAPHIC ENGINEERING LAB.**
Littoral Drift Estimates Along the Coastline of
Florida,
W77-06882 2L

**FLORIDA UNIV., GAINESVILLE. DEPT. OF
CIVIL ENGINEERING.**

Hydraulics of Sheet Flow in Wetlands,
W77-06929 8B

**FLORIDA UNIV., GAINESVILLE. DEPT. OF
CIVIL ENGINEERING; AND FLORIDA UNIV.,
GAINESVILLE. COASTAL AND
OCEANOGRAPHIC ENGINEERING LAB.**

Incipient Sediment Motion in Entrances with
Shell Beds,
W77-06930 2L

**FLORIDA UNIV., GAINESVILLE. DEPT. OF
ENVIRONMENTAL ENGINEERING SCIENCES.**

Nutrient Removal by Water Hyacinths,
W77-07036 5G

**FOOD AND DRUG ADMINISTRATION,
CINCINNATI, OHIO. VIROLOGY BRANCH.**

Persistence of Poliovirus 1 in Soil and on
Vegetables Grown in Soil Previously Flooded
with Inoculated Sewage Sludge or Effluent,
W77-07050 5C

**GDANSK TECHNICAL UNIV. (POLAND). INST.
OF HYDRAULIC ENGINEERING.**

Optimization Model of a System of Two Open-
Channel Hydroplants,
W77-06716 4A

**GENERAL ELECTRIC CO., SANTA BARBARA,
CALIF. CENTER FOR ADVANCED STUDIES.**

Monitoring Groundwater Quality: Illustrative
Examples,
W77-06673 5A

**GEOLOGICAL SURVEY, ALBANY, N.Y.
CENTRAL LAB.**

Partial Extraction of Metals from Aquatic Sedi-
ments,
W77-06781 5A

**GEOLOGICAL SURVEY, ALBUQUERQUE, N
MEX. WATER RESOURCES DIV.**

Review and Analysis of Hydrogeologic Con-
ditions Near the Site of a Potential Nuclear-
Waste Repository, Eddy and Lea Counties,
New Mexico,
W77-06974 5B

**GEOLOGICAL SURVEY, BALTIMORE, MD.
WATER RESOURCES DIV.**

Changing Needs and Opportunities in the Sedi-
ment Field,
W77-06964 2J

**GEOLOGICAL SURVEY, BATON ROUGE, LA.
WATER RESOURCES DIV.**

Floods in Louisiana, Magnitude and Frequen-
cy, Third Edition,
W77-06979 2E

**GEOLOGICAL SURVEY, BAY ST. LOUIS,
MISS. WATER RESOURCES DIV.**

Comprehensive Monitoring of Meteorology,
Hydraulics, and Thermal Regime of the San
Diego Aqueduct, California,
W77-06973 2D

**GEOLOGICAL SURVEY, EL PASO, TEX.
WATER RESOURCES DIV.**

Hydrologic Interpretation of Geophysical Data
from the Southeastern Hueco Bolson, El Paso
and Hudspeth Counties, Texas,
W77-06970 4B

ORGANIZATIONAL INDEX
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, JOUY-EN-JOSAS (FRANCE).

GEOLOGICAL SURVEY, HARRISBURG, PA.
WATER RESOURCES DIV.
 Sediment Discharge from an Area of Highway Construction, Applemans Run Basin, Columbia County, Pennsylvania,
 W77-06969 4C

GEOLOGICAL SURVEY, LAGUNA NIGUEL, CALIF.
 USGS Scientists Bring California Water Supply into Compliance with Federal Regulations,
 W77-06853 5G

GEOLOGICAL SURVEY, LAKEWOOD, COLO.
WATER RESOURCES DIV.
 Determination of Free Formic and Acetic Acids by Gas Chromatography Using the Flame Ionization Detector,
 W77-06961 5A

GEOLOGICAL SURVEY, MADISON, WIS.
WATER RESOURCES DIV.
 Geology and Ground Water in Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite,
 W77-06975 5B

GEOLOGICAL SURVEY, MADISON, WIS.
WATER RESOURCES DIV.; AND
GEOLOGICAL SURVEY TACOMA, WASH.
WATER RESOURCES DIV.
 Water in the Palouse River Basin, Washington,
 W77-06978 4B

GEOLOGICAL SURVEY, MENLO PARK, CALIF. WATER RESOURCES DIV.
 Numerical Models of Wind-Driven Circulation in Lakes,
 W77-06958 2H

Application of Digital Modelling to the Prediction of Radioisotope Migration in Groundwater,
 W77-06981 5B

GEOLOGICAL SURVEY, NASHVILLE, TENN.
WATER RESOURCES DIV.
 Improving Estimates of Streamflow Characteristics Using LANDSAT-1 (ERTS-1) Imagery,
 W77-06972 4A

GEOLOGICAL SURVEY, OKLAHOMA CITY, OKLA. WATER RESOURCES DIV.
 Reconnaissance of the Water Resources of the Clinton Quadrangle, West-Central Oklahoma,
 W77-06959 7C

GEOLOGICAL SURVEY, RESTON, VA.
WATER RESOURCES DIV.
 Surface Water Network Design by Regression Analysis Simulation,
 W77-06963 2E

Comparison of Iterative Methods of Solving Two-Dimensional Groundwater Flow Equations,
 W77-06965 2F

Hydrochemistry of the Lake Magadi Basin, Kenya,
 W77-06967 2K

Water Quality Management and the Distribution of Emission Rights by Sealed Tender Markets,
 W77-06976 5E

Diminution Ratios for Planning Construction-Area Sediment Controls,
 W77-06980 4D

GEOLOGICAL SURVEY, TACOMA, WASH.
WATER RESOURCES DIV.
 Preliminary Assessment of the Water Resources of the Tulalip Indian Reservation, Washington,
 W77-06971 4A

GEOLOGICAL SURVEY, TALLAHASSEE, FLA.
WATER RESOURCES DIV.
 Analog-Model Simulations for Secondary Canal Controls and Forward Pumping Water-Management Schemes in Southeast Florida,
 W77-06968 4B

GEOLOGICAL SURVEY, TUSCALOOSA, ALA.
WATER RESOURCES DIV.
 Urbanization and Flooding in Shades Creek Basin, Jefferson County, Alabama,
 W77-06977 4C

GEOLOGICAL SURVEY, WOODS HOLE, MASS. GEOLOGIC DIV.
 Delaware River: Evidence for Its Former Extension to Wilmington Submarine Canyon,
 W77-06966 2E

GEORGIA MARINE SCIENCE CENTER, SAVANNAH.
 Characteristics of Water Flow at the North End of the Wassaw Barrier Island Complex. Wassaw Island Erosion Study, Part II,
 W77-06939 2J

Sand Stabilization on the Dunes, Beach and Shoreface of a Historically Eroding Barrier Island. Wassaw Island Erosion Study, Part III,
 W77-06940 8G

GEORGIA UNIV., EXPERIMENT. DIV. OF FOOD SCIENCE.
 Environmental Factors Affecting Survival and Growth of *Vibrio Parahaemolyticus*. A Review,
 W77-06765 5C

GHANA UNIV., ACCRA. DEPT. OF PHYSICS.
 Circulation and Hydrographic Structure Over the Ghana Continental Shelf During the 1974 Upwelling,
 W77-06893 2L

GHENT RIJKSUNIVERSITEIT (BELGIUM). LABORATORIUM VOOR BODEMFYSISCHE.
 Depth and Seasonal Fluctuations in the Condition of the Groundwater of the Area Around the City of Ghent (Belgium), (In Dutch),
 W77-06681 2G

GIESSEN UNIV. (WEST GERMANY). TROPENINSTITUT; AND GIESSEN UNIV. (WEST GERMANY). SEKTION FUER PFLANZENBAU UND PFLANZENZUECHTUNG.
 The Effect of Different Methods on Growth, Development and Yield of Cotton, (In German),
 W77-06962 3F

GLADSTONE PUBLIC UTILITIES, MO.
 Contract Services Stretch Sewer Maintenance Budget,
 W77-06994 8G

GOETTINGEN UNIV. (WEST GERMANY). SYSTEMATISCH-GEBOTANISCHES INSTITUT.
 Indicator Values of Vascular Plants in Central Europe, (In German),
 W77-06803 2I

GREATER LONDON COUNCIL (ENGLAND). WATER AND WASTEWATER SECTION.
 London's Stormwater Problem,
 W77-06983 5D

HALLIBURTON SERVICES, DUNCAN, OKLA. ENVIRONMENTAL CONTROL DEPT.
 Testing and Grouting Leaking Joints,
 W77-06986 8G

HARVARD UNIV., CAMBRIDGE, MASS. CENTER FOR POPULATION STUDIES.
 A Sector Model for Regional and National Water Resources Planning,
 W77-06731 6A

HAWAII UNIV., HONOLULU. DEPT. OF GEOLOGY AND GEOPHYSICS.
 Waste Injection into Stratified Ground Water Bodies,
 W77-06855 5B

HITTMAN ASSOCIATES, INC., COLUMBIA, MD.
 An Executive Summary of Three EPA Demonstration Programs in Erosion and Sediment Control,
 W77-06671 5G

HÖLZMACHER, MCLENDON AND MURRELL, MELVILLE, N.Y.
 Study of Leachate at Landfill Sites 1975, Volume I,
 W77-06851 5B

HUNTER COLL., NEW YORK. DEPT. OF ENVIRONMENTAL HEALTH SCIENCES.
 Petroleum Hydrocarbons from Effluents: Detection in Marine Environment,
 W77-06660 5A

HYDROLOGIC ENGINEERING CENTER, DAVIS, CALIF.
 Hydrological Evaluation of Changes in Runoff Characteristics,
 W77-06732 4A

ICHTHYOLOGICAL ASSOCIATES, INC., DURMORE, PA.
 Influence of Gradient on the Distribution of Fishes in Conowingo Creek, Maryland and Pennsylvania,
 W77-06635 2I

ILLINOIS STATE WATER SURVEY, URBANA.
 On the Status of Hail Suppression,
 W77-06645 3B

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
 Environmental Pollution: Is There Enough Public Concern to Lead to Action,
 W77-06955 6G

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
 Characterization of Soluble Organic Matter in Leachate,
 W77-07039 5A

INSTITUT FUER WASSERWIRTSCHAFT, BERLIN (EAST GERMANY).
 On Large-Scale Simulation of Groundwater Flow Systems,
 W77-06713 4B

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, JOUY-EN-JOSAS (FRANCE). LABORATOIRE DE PHYSIOLOGIE DES POISSONS.
 Reproductive Cycle of Trout and Tench: Effect of Experimental Variations of the Temperature, (Etude Sur le Cycle Reproducteur de la

ORGANIZATIONAL INDEX
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, JOUY-EN-JOSAS (FRANCE).

- Truite Arc-En-Ciel et de la Tanche: Effet de Variations Experimentales de la Temperature), W77-06779 5C
- INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, TOULOUSE (FRANCE). STATION D'AGRONOMIE.**
 A Method of Evaluating a Field Water Capacity Using PF-3, (In French), W77-06844 2G
- INSTITUTE FOR BIOLOGICAL RESEARCH, BELGRADE (YUGOSLAVIA).**
 Changes in the Structure of Phytoplankton During the First Years of Existence of the Derdap Storage Reservoir, (In Serbo-Croatian), W77-06786 2H
- INSTITUTE OF OCEANOGRAPHIC SCIENCES, WORMLEY (ENGLAND).**
 Mixing in Upper Layer of a Lake During Heating Cycle, W77-06649 2H
- INSTITUTE OF SCIENCE, BOMBAY (INDIA). INORGANIC AND NUCLEAR CHEMISTRY LAB.**
 A Preliminary Survey of Mercury in Fish from Bombay and Thana Environment, W77-06785 5C
- INSTITUTE OF TERRESTRIAL ECOLOGY, EDINBURGH (SCOTLAND). WETLANDS RESEARCH GROUP.**
 A Pneumatic Grab for Obtaining Large, Undisturbed Mud Samples: Its Construction and Some Applications for Measuring the Growth of Larvae and Emergence of Adult Chironomidae, W77-06613 5A
- INSTYTUT GOSPODARSKI KOMUNALNEJ, WARSAW (POLAND).**
 Effect of Water Work's Sludge on Waste Water Treatment, W77-07085 5D
- INSTYTUT PRZYRODNICZYCH PODSTAW, LUBIN (POLAND). PRODUKEJI ROSLINNEJ AR.**
 Dynamics of Phytoplankton Biomass in Two Lakes of Different Limnological Character, W77-06685 5C
 The Share of Algae with Different Dimensions in the Plankton of Two Lakes of Different Trophic Character in the Annual Cycle, W77-06692 5C
- INSTYTUT RYBACTWA SRODLADOWEGO, OLSZTYN-KORTOWO (POLAND). ZAKLAD HYDROBIOLOGII.**
 The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin I. Quantitative Relations and Qualitative Composition of the Bottom Fauna of the Konin Lakes Complex, (In Polish), W77-06749 5C
 The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin II. Changes in Time of Bottom Fauna, (In Polish), W77-06750 5C
 The Influence of Effluent Heated Waters on the Bottom Fauna of Lakes in the Vicinity of Konin III. An Effort to Explain the Causes and Results of Changes in the Bottom Fauna of Lakes as Influenced by the Inflow of Heated Waters, (In Polish), W77-06751 5C
- The Influence of Heated Effluent Waters on the Water Chemism of Konin Lakes, (In Polish), W77-06753 5C
- Long-Term Changes of the Pelagic Primary Production in Heated Lakes, (In Polish), W77-06755 5C
- The Influence of Heated Effluent Waters on the Thermal-Oxygen Relations and Water Transparency in the Konin Lakes Complex, (In Polish), W77-06756 5C
- INTERSTATE ELECTRONICS CORP., ARLINGTON, VA.**
 The Plight and Promise of On-Site Waste Water Treatment, W77-07010 5D
- IOWA STATE UNIV., AMES.**
 Concentration and Determination of Trace Organic Pollutants in Water, W77-07098 5A
- IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.**
 Backwashing of Granular Filters, W77-07037 5D
 The Electrolytic Respirometer-II. Use in Water Pollution Control Plant Laboratories, W77-07081 5D
- IOWA UNIV., IOWA CITY. DEPT. OF ZOOLOGY; AND IOWA UNIV., IOWA CITY. LAKESIDE LAB.**
 Dispersal and Dispersion of Pond Snails in an Experimental Environment Varying to Three Factors, Singly and in Combination, W77-06773 5C
- IOWA UNIV., IOWA CITY. INST. OF HYDRAULIC RESEARCH.**
 Laboratory Study of the Flexural Strength and Elastic Modulus of Freshwater and Saline Ice, W77-06661 2C
- ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LTD., HAIFA. HAIFA LABS.**
 Heavy Metal Concentrations in Water, Sediments, and Fish from Mediterranean Coastal Area, Israel, W77-06782 5C
- JOHNSON AND ANDERSON, INC., PONTIAC, MICH.**
 Evaluation of In-Line and Side-Line Flow Equalization Systems, W77-07041 5D
- KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRICULTURAL ENGINEERING.**
 Land Forming Systems to Improve Water Use Efficiency, W77-06761 3F
- KANSAS WATER RESOURCES RESEARCH INST., LAWRENCE.**
 Further Development and Testing of a Stream-Aquifer System Model, W77-06762 2F
- KAZAN INST. OF BIOLOGY (USSR).**
 Dependence of Water Absorption by the Cell Walls of Plant Leaves on the Volume of the Free Space, (In Russian), W77-06827 2I
- KAZANSKII GOSUDARSTVENNYI MEDITSINSKII INSTITUT (USSR).**
 Hygienic Effectiveness of Measures for Decontaminating Effluents at Petrochemical Plants, (In Russian), W77-07069 5D
- KENTUCKY DEPT. FOR NATURAL RESOURCES AND CONSERVATION, FRANKFORT. OFFICE OF PLANNING AND RESEARCH.**
 Debris Basins for Control of Surface Mine Sedimentation, W77-06672 5G
- LAJOS KOSSUTH UNIV., DEBRECEN (HUNGARY). DEPT. OF BOTANY.**
 Investigation of Precipitation Within Forest Ecosystems, (In Hungarian), W77-06797 2B
- LAVAL UNIV., QUEBEC. DEPARTMENT DE BIOLOGIE.**
 Nutrients, Chlorophyll, and Internal Tides in the St. Lawrence Estuary, W77-06910 5B
- LEEDS UNIV. (ENGLAND). WELLCOME MARINE LAB.**
 The Fauna of the Polluted River Tees Estuary, W77-06638 5C
- LIMNOLOGISCHE STATION NIEDERRHEIN IN DER MAX-PLANCK-GESELLSCHAFT Z.F.D.W., KREFELD (WEST GERMANY).**
 On the Self-Purification of Natural Waters, (In German), W77-07038 5G
- LOS ALAMOS SCIENTIFIC LAB., N. MEX.**
 Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer, W77-06658 5B
- LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.**
 Methane-Derived Carbonate Cements in Barrier and Beach Sands of a Subtropical Delta Complex, W77-06677 2L
 Evidence for Strong Currents and Turbulence in a Deep Coral Reef Groove, W77-06904 2L
- LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.; AND LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLANDS RESOURCES.**
 Computing Eolian Sand Transport from Routine Weather Data, W77-06669 2L
- LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF FOOD SCIENCE.**
 Adsorption of Polychlorinated Biphenyl (Aroclor 1254) on Shrimp, W77-06758 5C
- LOYOLA UNIV., LOS ANGELES, CALIF.**
 Anaerobic Filter Treats Waste Activated Sludge, W77-07078 5D
- LOYOLA UNIV. OF CHICAGO, ILL.**
 LAS Inhibition of Diffusion and Uptake of Tritiated Uridine During Teleost Embryogenesis, W77-06611 5C

ORGANIZATIONAL INDEX

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

MAINE UNIV. AT ORONO. LAND AND WATER RESOURCES INST.

The Historic and Present Relationships Between Phytoplankton, Limiting Nutrients, and Sediment-Water Geochemical Processes in Selected Maine Lakes, W77-06741 5C

MANITOBA UNIV., WINNIPEG. DEPT. OF ECONOMICS.

An Input-Output Analysis of Environmental Preservation, W77-06706 6G

MARINE LAB., ABERDEEN (SCOTLAND).

Loch Ewe Bag Experiment, 1974, W77-06627 5A

MARYLAND UNIV., BALTIMORE COUNTY, BALTIMORE. DEPT. OF BIOLOGICAL SCIENCES.

The Measurement of Temperature Tolerance: Verification of an Index, W77-06764 5C

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF OCEAN ENGINEERING.

Impact of Oil Spillage from World War II Tanker Sinkings, W77-06877 5C

MASSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.

Short Course Proceedings: Applications of Stormwater Management Models, W77-07066 5B

MASSACHUSETTS UNIV., AMHERST. DEPT. OF ZOOLOGY.

Seasonal changes in the Respiration of Pumpkinseed, Lepomis gibbosus, Correlated with Temperature, Day Length, and Stage of Reproductive Development, W77-06768 5C

MATHEWS (A. A.), INC., ROCKVILLE, MD.

Cost Comparison Between Subterrene and Current Tunneling Methods, W77-06662 8A

Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix A--Baseline Cost Analyses, W77-06663 8A

Cost Comparison Between Subterrene and Current Tunneling Methods, Appendix B--Subterrene Cost Analyses, W77-06664 8A

METEOROLOGICAL OFFICE, NEW DELHI (INDIA).

Area-Depth Relations for Frequency Values of Rainfall, W77-06647 2B

METEOROLOGICAL OFFICE, POONA (INDIA).

Simple Formulae for the Estimation of Wet Bulb Temperature and Precipitable Water, W77-06646 2B

MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON. DEPT. OF CIVIL ENGINEERING.

Influence of Phosphorus Removal on Solids Budget, W77-07032 5D

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ATMOSPHERIC AND OCEANIC SCIENCE.

Coastal Meteorological Networks to Determine Effects of Nuclear Plant Cooling Systems, W77-06643 2B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND INDUSTRIAL HEALTH.

The Effects of Methoxychlor on Riffle Invertebrate Populations and Communities, W77-06614 5C

MIDDLESEX POLYTECHNIC, LONDON (ENGLAND).

Sediments and Water Quality of Urban Storm Water, W77-06984 5B

MINISTERIO DE OBRAS PUBLICAS, BARCELONA (SPAIN). COMPUTER CENTRE.

Construction and Adjustment of a Two-Layer Mathematical Model of the Llobregat Delta, W77-06722 4A

MINISTERIO DE OBRAS PUBLICAS, BARCELONA (SPAIN). STUDY AND EXPERIMENTAL CENTRE.

Modele Mathematique de Simulation du Systeme des Ressources Hydrauliques Superficielles du Llobregat, W77-06727 4A

MINISTERIO DE OBRAS PUBLICAS, MADRID (SPAIN). GEOLOGICO SERVICIO.

Optimization of a Three-Reservoir System by Dynamic Programming, W77-06720 4A

Conjunctive Use of the Tajo-Segura Aqueduct Surface System and the Aquifers of the La Mancha Area, W77-06728 4B

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, LOWESTOFT (ENGLAND). FISHERIES LAB.

Ammonia Concentration in Relation to Ammonia Toxicity During a Rainbow Trout Rearing Experiment in a Closed Freshwater-Sea-water System, W77-06743 5C

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, LOWESTOFT (ENGLAND). FISHERIES RADIOBIOLOGICAL LAB.

The Accumulation of Organic Mercury from Sea Water by the Plaice, Pleuronectes platessa L., W77-06607 5C

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.

The Removal of Organic Matter from Water Supplies by Ion Exchange, W77-06760 5F

Conference on Research in Tunneling and Excavation Technology, W77-06885 8E

MINNESOTA UNIV., MINNEAPOLIS.

LIMNOLOGICAL RESEARCH CENTER.

Iron-Rich Rhythmically Laminated Sediments in Lake of the Clouds, Northeastern Minnesota, W77-06901 2J

MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM, OCEAN SPRINGS, MISS. GULF COAST RESEARCH LAB.

Mississippi Sound Temporal and Spatial Distribution of Nutrients, W77-06932 5B

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF CIVIL ENGINEERING.

The Effect of High Purity Oxygen on the Activated Sludge Process, W77-07043 5D

MISSOURI UNIV.-COLUMBIA. DEPT. OF CIVIL ENGINEERING.

The Use of Polymers for Improving Chemical Sludge Dewatering on Sand Beds, W77-07033 5D

MONTGOMERY COUNTY SANITARY DEPT., DAYTON, OHIO.

Conditioning and Land Application of Aerobically Digested Sludge, W77-07058 5D

MOSKOVSKII ENERGETICHESKII INSTITUT (USSR). DEPT. OF HYDROPOWER.

Methods for Control of the Regimes for Water Resources Systems, W77-06717 4A

MOSKOVSKII GOSUDARSTVENNYI MEDITSINSKII INSTITUT (I) (USSR). DEPT. OF GENERAL HYGIENE.

Quantitative Analysis of Enteroviruses in Water with Various Degrees of Pollution, (In Russian), W77-07070 5A

MOSS LANDING MARINE LABS., CALIF.

Effects of Engineering Activities on the Ecology of Pismo Clams, W77-06886 5C

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OHIO.

Trends in Sludge Treatment and Disposal Practices in the United States, W77-07083 5D

Waste Water Reuse Practice in the United States, W77-07087 5D

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WALLOPS ISLAND, VA. WALLOPS FLIGHT CENTER.

Observations of Wind-Generated Waves on Variable Current, W77-06896 2L

NATIONAL ENVIRONMENTAL SATELLITE SERVICE, WASHINGTON, D.C.

River Basin Snow Mapping at the National Environmental Satellite Service, W77-06915 2C

NATIONAL FIELD INVESTIGATIONS CENTER, DENVER, COLO.

Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72, W77-07076 5A

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

An Electronic System to Monitor the Effects of Changes in Water Quality on Fish Opercular Rhythms, W77-06610 5C

NATIONAL MARINE FISHERIES SERVICE, AUK BAY, ALASKA. AUK BAY FISHERIES

ORGANIZATIONAL INDEX

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

LAB; AND NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES CENTER.

Baseline/Reconnaissance Characterization, Littoral Biota, Gulf of Alaska and Bering Sea, W77-06833 6G

NATIONAL MARINE FISHERIES SERVICE, MILFORD, CONN. MIDDLE ATLANTIC COASTAL FISHERIES CENTER.

Respiratory Response of Cunners to Silver, W77-06789 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH.

Dissolved Nitrogen, Dissolved Oxygen and Related Water Temperatures in the Columbia and Lower Snake Rivers, 1965-1969, W77-06925 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. MARINE MAMMAL DIV.

Baseline Characterization of Marine Mammals in the Bering Sea, W77-06794 6G

Abundance and Seasonal Distribution of Marine Mammals in the Gulf of Alaska, W77-06795 6G

Distribution and Abundance of Bowhead and Belukha Whales in the Bering and Chukchi Seas, W77-06796 6G

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES CENTER.

Ecosystem Dynamics Birds and Marine Mammals. Part I: Preliminary Estimates of Pinniped - Finfish Relationships in the Bering Sea, W77-06806 6G

Ecosystem Dynamics Birds and Marine Mammals. Part II: Food Web Structure and Trophic Relations of Bering Sea Avifauna (Preliminary Report), W77-06807 6G

Ecosystem Dynamics Birds and Marine Mammals. Part III: A Dynamic Numerical Marine Ecosystem Model for Evaluation of Marine Resources in Eastern Bering Sea, W77-06808 6G

Resources of Non-Salmonid Pelagic Fish of the Eastern Bering Sea and the Gulf of Alaska, W77-06832 6G

Baseline Studies of Fish and Shellfish Resources of Norton Sound and the Southeastern Chukchi Sea, W77-06839 6G

Ichthyoplankton of the Eastern Bering Sea, W77-06845 6G

Effect of Atmospheric Gas Supersaturation Caused by Dams on Salmon and Steelhead Trout of the Snake and Columbia Rivers (A Review of the Problem and the Progress Toward a Solution, 1974), W77-06927 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MICH. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.

The Observed Winter Circulation of Lake Ontario, W77-06655 2H

Lake St. Clair Hydrologic Transfer Factors. W77-06879 2H

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, COLO. ENVIRONMENTAL RESEARCH LABS.

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 1: Marine Mammals, Marine Birds. W77-06793 6G

Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports July-September 1976. Volume 2: Fish, Plankton, Benthos, Littoral. W77-06825 6G

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, COLO. MARINE ECOSYSTEMS ANALYSIS PROGRAM OFFICE.

A Pilot Study on the Design of a Petroleum Hydrocarbon Baseline Investigation for Northern Puget Sound and Strait of Juan de Fuca, W77-06875 5C

The New York Bight Project - 1975; Stony Brook, Long Island, New York. W77-06876 5G

A Test Particle Dispersion Study in Massachusetts Bay. W77-06880 2L

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ROCKVILLE, MD. OFFICE OF COASTAL ZONE MANAGEMENT.

Coastal Facility Guidelines: A Methodology for Development with Environmental Case Studies on Marinas and Power Plants, W77-06936 6G

Coastal Zone Management, Annotated Bibliography, W77-06937 2L

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WASH. PACIFIC MARINE ENVIRONMENTAL LAB.

Initial Zooplankton Investigations in Lower Cook Inlet, W77-06835 6G

Phytoplankton and Primary Productivity in the Northeast Gulf of Alaska, W77-06836 6G

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D.C.

Program Development Plan. Environmental Assessment of the Alaskan Continental Shelf, W77-06878 6G

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D.C. ENVIRONMENTAL DATA SERVICE; AND GEOLOGICAL SURVEY, EDGEWATER, MD. WATER RESOURCES DIV.

Measurement in a Marine Environment Using Low Cost Sensors of Temperature and Dissolved Oxygen, W77-06960 7B

NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OHIO.

The Legal Responsibility of Water Well Drillers, W77-06862 5G

Electric Logging, W77-06865 8G

NATIONAL WEATHER SERVICE, HONOLULU, HAWAII. PACIFIC REGION.

Forecasting Floods in Hawaii (Excluding Hawaii Island), W77-06873 4A

NATURAL RESOURCES DEFENSE COUNCIL, INC., PALO ALTO, CALIF.

Who's Minding the Shore. A Citizens' Guide to Coastal Management, W77-06935 5G

NAVAL ENVIRONMENTAL PREDICTION RESEARCH FACILITY, MONTEREY, CALIF.

An Approximating Polynomial for the Computation of Saturation Vapor Pressure, W77-06652 2B

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF. DEPT. OF PHYSICS AND CHEMISTRY.

In Situ Acoustic Measurements of Microbubbles at Sea, W77-06916 2L

NEBIT-DAG BUR. GREENING 'TURKMENEFT' ASSOC. (USSR).

Irrigation of the Nebit-Dag Plantings by Mineralized Ground Water, (In Russian), W77-06691 3C

NEVADA UNIV., RENO. DESERT RESEARCH INST.

Water Quality Simulation of Tahoe-Truckee System, Nevada-California-Volume I, W77-07075 5B

NEVADA UNIV. SYSTEM, LAS VEGAS. WATER RESOURCES CENTER.

Mineral Content of Selected Geothermal Waters, W77-06667 3E

NEW BRUNSWICK UNIV., FREDERICTON. DEPT. OF CIVIL ENGINEERING.

Plant Data Analysis of Temperature Significance in the Activated Sludge Process, W77-07046 5D

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION, BOSTON, MASS.

Treatment of Combined Sewer Overflows Via Thin Film Chemistry, W77-07034 5D

NEW HAMPSHIRE UNIV., DURHAM.

Blank and Salinity Corrections for Automated Nutrient Analysis of Estuarine and Sea Waters, W77-06938 5A

NEW HAMPSHIRE UNIV. DURHAM. DEPT. OF CHEMICAL ENGINEERING.

Mixing and Circulation of Lakes and Reservoirs with Air Plumes, W77-06633 5G

NEW JERSEY INST. OF TECH., NEWARK. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.

Sludge Dewatering Pilot Plant Design. Part 2, W77-07088 5D

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF CIVIL ENGINEERING.

Optimal Design and Operation of Reservoir Systems, W77-06721 4A

NEW YORK SEA GRANT INST., ALBANY.

Lake Ontario Atlas: Surface Waves, W77-06884 2H

ORGANIZATIONAL INDEX

PURDUE UNIV., LAFAYETTE, IND. WATER RESOURCES RESEARCH CENTER.

NEWCASTLE-UPON-TYNE UNIV. (ENGLAND).

DEPT. OF ZOOLOGY.

Toxicity of Fluoride to Brown Trout Fry (Salmo trutta),
W77-06628 5C

NORTH CAROLINA STATE UNIV., RALEIGH.

DEPT. OF GEOSCIENCES; AND NORTH

CAROLINA STATE UNIV., RALEIGH. CENTER FOR MARINE AND COASTAL STUDIES.

Exchange Through a Barrier Island Inlet: Additional Evidence of Upwelling Off the Northeast Coast of North Carolina,
W77-06654 2L

NORTH CAROLINA STATE UNIV., RALEIGH.

DEPT. OF SOIL SCIENCE.

Application of Municipal Refuse and Liquid Sewage Sludge to Agricultural Land: II. Lysimeter Study,
W77-07080 5D

NORTH CAROLINA UNIV. AT CHAPEL. DEPT. OF CITY AND REGIONAL PLANNING.

Open Space and Urban Water Management - Phase II: Case Studies and Findings,
W77-06917 6B

NORTH CAROLINA UNIV., CHAPEL HILL.

DEPT. OF BOTANY.

The Distribution of Natural and Anthropogenic Elements and Compounds in Precipitation Across the U.S.; Theory and Quantitative Models,
W77-06675 2B

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION, RALEIGH. DIV. OF INLAND FISHERIES.

First Reported Incidence of Gas-Bubble Disease in the Heated Effluent of a Steam Generating Station,
W77-06922 5C

NORTHERN TIER REGIONAL PLANNING AND DEVELOPMENT COMMISSION, TOWANDA, PA.

Flood Management Study,
W77-06952 6F

O'BRIEN AND GERE ENGINEERS, INC.,

SYRACUSE, N.Y.

Single P/C Unit Removal of Nutrients from Combined Sewer Overflows,
W77-07031 5D

OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.

Bonding of Calcium and Potassium by Vermiculite and Kaolinite Clays as Affected by H-Clay Addition,
W77-06872 2G

OKLAHOMA STATE UNIV., STILLWATER.

DEPT. OF GEOGRAPHY.

A New Reservoir and Recreational Behavior,
W77-06956 6B

OKLAHOMA STATE UNIV., STILLWATER.

DEPT. OF ZOOLOGY.

Measurements of Planktonic Biomass in a Reservoir,
W77-06679 5A

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF CIVIL ENGINEERING.

Investigation of Flushing Time in the Lafayette River, Norfolk, Virginia,
W77-06881 2L

ONTARIO RESEARCH FOUNDATION,

SHERIDAN PARK. (ASSIGNEE).

Renovation of Waste Water,
W77-07004 5D

OREGON STATE UNIV., CORVALLIS; AND SOIL CONSERVATION SERVICE, WASHINGTON, D.C.

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Umatilla Drainage Basin,
W77-06602 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Area, Grande Ronde Drainage Basin,
W77-06603 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Powder Drainage Basin,
W77-06604 2G

Oregon's Long Range Requirements for Water. General Soil Map Report with Irrigable Areas, Malheur River Drainage Basin,
W77-06605 2G

Oregon's Long-Range Requirements for Water. General Soil Map Report with Irrigable Areas, Owyhee Drainage Basin,
W77-06606 2G

OREGON STATE UNIV., CORVALLIS. DEPT. OF ZOOLOGY.

Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska,
W77-06810 6G

OREGON STATE UNIV., CORVALLIS, SCHOOL OF OCEANOGRAPHY.

Continental Shelf Waves and Alongshore Variations in Bottom Topography and Coastline,
W77-06891 2L

An Analysis of Inertial Oscillations Observed Near Oregon Coast,
W77-06892 2L

OSLO UNIV. (NORWAY). INST. OF ECONOMICS.

The Generation of Residual Flows in Norway: An Input-Output Approach,
W77-06698 5G

PACIFIC NORTHWEST WATER LAB., CORVALLIS, OREG.

Observations on Gas Bubble Disease in Adult Columbia River Sockeye Salmon (Oncorhynchus Nerka),
W77-06924 5C

PADOVA UNIV. (ITALY). ISTITUTO DI BOTANICA E FISILOGIA VEGETALE.

The Algal Flora in the Thermal Baths of Montegrotto Terme (Padua). Its Distribution Over One-Year Period,
W77-06770 5C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.

Accumulation of Heavy Metals in Soils from Extended Waste Water Irrigation,
W77-07049 5B

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.

Time-Distribution of Storm Rainfall in Pennsylvania,
W77-07022 2B

PIRNIE (MALCOLM), INC., WHITE PLAINS, N. Y.

Energy Conservation and Heat Recovery in Waste Water Treatment Plants,
W77-07024 5D

PITTSBURGH UNIV., PA. DEPT. OF ECONOMICS.

Optimal Investment in Pollution Control Capital in a Neoclassical Growth Context,
W77-06705 6G

PLUMMER AND MCDANNALD CO., GALENA, OHIO.

Bits and Pieces,
W77-06866 8G

PLUMMER AND MCDANNALD DRILLING CO. GALENA, OHIO.

Pumping Systems: The Simpler, The Better,
W77-06856 8C

POLISH ACADEMY OF SCIENCES, KRAKOW. ZAKLAD BIOLOGII WOD.

The Influence of Acrolein and Hydrocrylic on the Development Dynamics of Aquatic Bacteria,
W77-06690 5C

POLISH ACADEMY OF SCIENCES, WARSAW. INST. OF ECOLOGY; AND POLISH ACADEMY OF SCIENCES, WARSAW, DEPT. OF HYDROBIOLOGY.

Primary and Secondary Production of Plankton in Heated Lakes, (In Polish),
W77-06752 5C

Occurrence and Growth of Dreissena Polymorpha Pall. in Lakes Included in a Cooling System, (In Polish),
W77-06754 5C

POLISH ACADEMY OF SCIENCES, WARSAW. LAB. OF ECOLOGICAL BIOENERGETICS.

The Mining Fauna in Four Macrophyte Species in Mikolajskie Lake,
W77-06688 5C

PORTSMOUTH POLYTECHNIC (ENGLAND) DEPT. OF BIOLOGICAL SCIENCES.

Effect of Salinity on Spore Germination of Terrestrial and Marine Fungi,
W77-06772 5C

PUERTO RICO UNIV., MAYAGUEZ. WATER RESOURCES RESEARCH INST.

Particle Characteristics and Dispersal Patterns of Sugar Cane Wastes in Selected Rivers and Estuaries of Puerto Rico,
W77-06632 5B

PURDUE UNIV., LAFAYETTE, IND. DEPT. OF AGRONOMY.

Forms of Sulfur in Sewage Sludge,
W77-07044 5A

PURDUE UNIV., LAFAYETTE, IND. LAB FOR APPLICATIONS OF REMOTE SENSING.

A Study of the Utilization of EREP Data from the Wabash River Basin,
W77-06670 7B

PURDUE UNIV., LAFAYETTE, IND. WATER RESOURCES RESEARCH CENTER.

Monroe Reservoir, Indiana, Part I: Hydrologic Circulation, Sedimentation, and Water Chemistry Part II: Nutrient Relations,
W77-06982 5C

ORGANIZATIONAL INDEX

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF GEOGRAPHY.

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF GEOGRAPHY.

A Note on Temperature and Humidity Profile
Measurement Over Forests Using Diodes,
W77-06653 7B

RENSELAER POLYTECHNIC INST., TROY, N.Y.

Adsorption, Coagulation and Filtration Make a
Useful-Treatment Combination-Part 2,
W77-07077 5D

RENSELAER POLYTECHNIC INST., TROY, N.Y. FRESH WATER INST.

Means for Protecting the Drinking Water Quality
of Lake George, New York,
W77-06682 5G

A General Model of Microbial Growth and
Decomposition in Aquatic Ecosystems,
W77-06684 5C

Nutrient Removal and Sludge Disposal Within
Septic Systems-Phase III,
W77-06686 5D

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).

Indices of Water Restriction and Water Deficiency
Tolerance,
W77-06711 6A

RIVER RESEARCH INST., CALCUTTA (INDIA).

A Study to Forecast the Waves at Digha,
W77-06648 2L

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FLA.

Evaluation of Potential Indicators of Sub-
Lethal Toxic Stress on Marine Zooplankton
(Feeding, Fecundity, Respiration and Excretion):
Controlled Ecosystem Pollution Experiment,
W77-06617 5A

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FLA.

Experimental Observations on the Effects of
Copper on Copepods and Other Zooplankton:
Controlled Ecosystem Pollution Experiment,
W77-06619 5A

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN (ENGLAND).

Profiles and Evaporation,
W77-06898 2D

ROYAL MILITARY COLL. OF CANADA, KINGSTON (ONTARIO). DEPT. OF POLITICAL AND ECONOMIC SCIENCE.

Effluent Charges and Pollution Control: A Case
Study,
W77-06701 5G

RUTGERS. THE STATE UNIV., NEW BRUNSWICK, N. J. DEPT. OF BOTANY.

Correlation Coefficients and Concentration
Factors of Copper and Lead in Seawater and
Benthic Algae,
W77-06783 5C

SAHAND CO., TEHRAN (IRAN).

The Conjunctive Use of a Multi-Reservoir
System and a Dual-Purpose Desalting Plant,
W77-06714 4B

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.

Monitoring the Marine Environment Through
Sedimentation,
W77-06651 2L

Long-Term Lead Accumulation in Abalone
(*Haliotis* Spp.) Fed on Lead-Treated Brown
Algae (*Egregia laevigata*),
W77-06776 5C

Particulate Transport of Radionuclides ¹⁴C and
⁵⁵Fe to Deep Waters in the Pacific Ocean,
W77-06902 5B

The Solubility of Nitrogen, Oxygen and Argon
in Water and Seawater,
W77-06923 5C

SIR JOHN CASS COLL., LONDON (ENGLAND). SCHOOL OF SCIENCES AND TECHNOLOGY.

Heavy Metals in Macroinvertebrates and Fish
from the Lower Medway Estuary, Kent,
W77-06790 5C

SMITH (A. O.), TIPP CITY, OHIO. ELECTRIC MOTOR DIV.

It's All on the Nameplate: Everything You Al-
ways Wanted to Know About Jet Pumps,
W77-06854 8C

SMITHSONIAN INSTITUTION, WASHINGTON, D. C. DIV. OF SEDIMENTOLOGY.

Nile Cone: Late Quaternary Stratigraphy and
Sediment Dispersal,
W77-06650 2L

SOIL CONSERVATION SERVICE, FORT WORTH, TEX.

Current Methods Used in the Soil Conservation
Service to Estimate Sediment Yield,
W77-06657 4D

SOUTH CAROLINA WILDLIFE AND MARINE RESOURCES DEPT., CHARLESTON. MARINE RESOURCES RESEARCH INST.

Algal Supplement Enhancement of Static and
Recirculating System,
W77-06933 5C

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT, EL SEGUNDO.

An Offshore Biomonitoring System for
Chlorinated Hydrocarbons,
W77-06641 5A

SOUTHERN PIEDMONT CONSERVATION RESEARCH CENTER, WATKINSVILLE, GA.

Loss of 2,4-D in Runoff from Plots Receiving
Simulated Rainfall and from a Small Agricul-
tural Watershed,
W77-06908 5B

SPRINGFIELD SANITARY DISTRICT, ILL.

Underflow from Sludge-Irrigated Cropland,
W77-07056 5B

ST. LAWRENCE CEMENT CO., MISSISSAUGA, (ONTARIO).

Burning Waste Chlorinated Hydrocarbons in a
Cement Kiln,
W77-06946 5E

STANFORD RESEARCH INST., MENLO PARK, CALIF.

Energy Development: The Environmental
Tradeoffs. Volume 4: The Background Papers,
W77-06957 6G

STATE UNIV. OF NEW YORK AT ALBANY. DEPT. OF ECONOMICS.

Adjustment Costs and Optimal Waste Treat-
ment,
W77-06699 5D

STEPHEN F. AUSTIN STATE UNIV., NACOGDOCHES, TEX. DEPT. OF BIOLOGY.

Electrically Powered Sampler for Benthic
Macroinvertebrates,
W77-06757 7B

STOCKHOLM UNIV. (SWEDEN). WALLENBERG LAB.

Health Effects of Multipurpose Use of Water,
W77-06775 5C

SURREY UNIV., GUILFORD (ENGLAND). DEPT. OF MICROBIOLOGY.

The Toxic Effects of Selected Heavy Metals on
Unadapted Populations of *Vorticella* Conval-
laria Var Similis,
W77-06636 5C

TAHAL CONSULTING ENGINEERS LTD., TEL- AVIV (ISRAEL). RESEARCH AND DEVELOPMENT DIV.

A Dynamic Multisector Programming Ap-
proach to Regional Water Resource Manage-
ment,
W77-06737 6A

TATSUO TANAKA MEMORIAL BIOLOGICAL STATION, TOKYO (JAPAN).

Notes on the Nesting Success and Fecundity of
the Anemonefish *Amphiprion clarkii* at
Miyake-Jima, Japan,
W77-06763 5C

TECHNICAL UNIV. OF WARSAW (POLAND). INST. OF CHEMICAL ENGINEERING.

Study on Sewage Flow Dynamics Through
Dorr Type Clarifier on Stream, (Synopsis),
W77-07048 5D

TECHNICAL UNIV., WARSAW (POLAND). INST. OF ENVIRONMENTAL ENGINEERING.

The Multi-Step Method for Simulation and Op-
timization of Vistula River Planning Alterna-
tives,
W77-06734 4A

TECHNION - ISRAEL INST. OF TECH. HAIFA. DEPT. OF AGRICULTURAL ENG.

Integration of Aquifers in Flood Control Pro-
jects,
W77-06723 4A

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS). GEOPHYSICAL LAB.

Performance of a Recharge and Recovery
System in an Aquifer with Uniform Flow,
W77-06905 2F

TECHNISCHE UNIVERSITAET, BRUNSWICK (WEST GERMANY). LEICHTWEISS INST. FOR WATER RESEARCH.

Optimal Operations of Reservoirs in the Harz
Mountains,
W77-06715 4A

TECHNISCHE UNIVERSITAET, DRESDEN (EAST GERMANY).

On the Application of Optimization Techniques
to Conceptual Catchment Models,
W77-06709 2A

TEL AVIV UNIV. (ISRAEL). DEPT. OF ECONOMICS.

Uncertainty and the Choice of Pollution Con-
trol Instruments,
W77-06704 6G

Two-Goal Regional Environmental Policy: The
Case of the Santa Ana River Basin,
W77-06707 5G

ORGANIZATIONAL INDEX

WATER RESEARCH ASSOCIATION, MARLOW (ENGLAND).

TEMPLE UNIV., PHILADELPHIA, PA.

(ASSIGNEE).

Process for the Treatment of Waste Water by Heterogeneous Photosensitized Oxidation, W77-07006 5D

TEXAS A AND M UNIV., COLLEGE STATION. CENTER FOR APPLIED GEOSCIENCES.

A Single Field of View Method for Retrieving Tropospheric Temperature Profiles from Cloud-Contaminated Radiance Data, W77-06887 2B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CIVIL ENGINEERING.

A Laboratory Study of Fluid and Soil Mechanics Processes During Hydraulic Dredging (Hydraulische und Bodentechnische Vorgänge beim Grundsäugen), W77-06883 8D

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF VETERINARY PHYSIOLOGY AND PHARMACOLOGY.

Induction of Hepatic Microsomal Enzymes by Aroclor 1254 in *Ictalurus punctatus* (Channel Catfish), W77-06759 5C

THAYER SCHOOL OF ENGINEERING, HANOVER, N.H.

Anaerobic Digestion and Membrane Separation for the Treatment of Domestic Sewage, W77-06631 5D

TH CORP., LINDENHURST, N.Y. (ASSIGNEE).

Method of Applying Ozone and Sonic Energy to Sterilize and Oxidize Waste Water, W77-07007 5D

TOMSKII MEDITSINSKII INSTITUT (USSR).

Water Decontamination in Northern Regions by Impulse Electric Charges, (In Russian), W77-06791 5D

TOULOUSE-3 UNIV. (FRANCE).

LABORATOIRE D'ECOPHYSIOLOGIE DES ANIMAUX.

Effect of Two Rearing Conditions on Growth and Body Composition in Carp (*Cyprinus Carpio* L), (Influence de Deux Modes d'Elevage sur la Croissance et la Composition Corporelle de la Carpe Commune), W77-06769 5C

UKRAINIAN RESEARCH INST. OF THE FISH INDUSTRY, KIEV (USSR).

Experiment with a Multipoint System for Judging Carp Fattening Ponds, (In Russian), W77-06798 2H

UKRAINSKII NAUCHNO-ISSEDOVATELSKII INSTITUT EKSPERIMENTALNOI VETERINARII, KHARKOV (USSR).

VETERINARY RESEARCH STATION.

Optic Device for Observations of Small Organisms Under Water, (In Russian), W77-06926 7B

UNION CARBIDE CORP., TONAWANDA, N.Y. LINDE DIV.

UNOX System for Waste Water Treatment, W77-07014 5D

UNITED ENGINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PA.

Guidelines for the Preparation of Environmental Reports for Fossil-Fueled Steam Electric Generating Stations, W77-06918 6G

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION, PARIS (FRANCE).

Mathematical Models in Hydrology, W77-06708 2A

A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines, W77-06850 5A

UNIVERSAL OIL PRODUCTS, ST. PAUL, MINN. JOHNSON DIV.

Hydraulics and Economics of Well Field Layout, W77-06863 8B

UNIVERSIDAD COMPLUTENSE DE MADRID (SPAIN). DEPT. OF BOTANY AND PLANT PHYSIOLOGY.

Ecological Data on Continental Aquatic Vegetation, (In Spanish), W77-06784 2I

UNIVERSITAET HOHENHEIM (LANDWIRTSCHAFTLICHE HOCHSCHULE) (WEST GERMANY).

Distribution and Indicatory Value of the Submerged Macrophytes in the Flowing Waters of the Friedberger Au, (In German), W77-06802 5C

UPPSALA UNIV. (SWEDEN). DEPT. OF PHYSICAL GEOGRAPHY; AND UPPSALA UNIV. (SWEDEN). DIV. OF HYDROLOGY.

Water Chemistry and Water Quality, W77-06778 5A

UPPSALA UNIV. (SWEDEN). INST. OF ZOOPHYSIOLOGY.

Rotary-Flow Technique for Testing Fitness of Fish, W77-06608 5C

URBAN SYSTEMS RESEARCH AND ENGINEERING, INC., CAMBRIDGE, MASS.

The Growth Shapers: The Land Use Impacts of Infrastructure Investments, W77-06601 6D

UTAH STATE UNIV., LOGAN.

A Nonlinear Multilevel Transportation Model for Water Resource-Water Quality Management, W77-07096 5B

UTAH STATE UNIV., LOGAN. DEPT. OF SOIL AND METEOROLOGY.

Potassium in an Arid Loessial Soil: Changes in Availability as Related to Cropping and Fertilization, W77-06870 3F

UTAH STATE UNIV., LOGAN. INST. FOR SOCIAL SCIENCE RESEARCH ON NATURAL RESEARCH.

Improvement of Planning for Post-Development Water Resource Management: A Study of the Weber Basin Project, W77-06739 6B

VETERANS ADMINISTRATION HOSPITAL, KANSAS CITY, MO.

Drugs and Drug Metabolites as Environmental Contaminants: Chlorophenoxyisobutyrate and Salicylic Acid in Sewage Water Effluent, W77-07045 5A

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR THE STUDY OF PUBLIC CHOICE.

Polluters' Profits and Political Response: Direct Control Versus Taxes: Comments and Reply, W77-06700 5G

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. COLL. OF ARCHITECTURE AND URBAN STUDIES.

Design Study of Environmental and Human Cultural Information System Needs in Urban Water Resource Development, W77-06634 6B

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRONOMY.

Pollutant Movement to Shallow Ground Water Tables from Swine Waste Lagoons, W77-06742 5B

WALTHAM PUBLIC WORKS, MASS.

New Programs Improve Sensitive Areas of Water and Sewer Systems, W77-06995 8G

WARSAW UNIV. (POLAND). DEPT. OF HYDROBIOLOGY.

Stratification of Kinetic Origin and its Biological Consequences in a Neotropical Man-Made Lake, W77-06683 2H

Ecological Relations Between Invertebrates and Submerged Macrophytes in the Lake Littoral, W77-06694 5C

WASHINGTON STATE UNIV., PULLMAN. COLL. OF AGRICULTURE.

Economic Analysis of Alternative Groundwater Withdrawal Rates in Conjunction with Surface Water Irrigation, W77-06740 4B

WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY.

Plankton of the Gulf of Alaska - Ichthyoplankton, W77-06834 6G

WASHINGTON UNIV., SEATTLE. FISHERIES RESEARCH INST.

Assessment of Pelagic and Nearshore Fish in Three Bays on Southeast Kodiak Island, W77-06846 6G

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).

The Use of Oxygen to Treat Sewage in a Rising Main, W77-06996 5D

Design and Control of Secondary Settlement Tanks, W77-07015 5D

WATER RESEARCH ASSOCIATION, MARLOW (ENGLAND).

Optimal Seasonal and Short-Term Operation of a Reservoir Used for Flood Control and Water Supply, W77-06724 4A

Streamflow Regulation by Artificial Recharge Fed from Upstream Surface Storage: Derivation of Control Rules, W77-06725 4A

ORGANIZATIONAL INDEX

WATER RESOURCES ENGINEERS INC., WALNUT CREEK, CALIF.

WATER RESOURCES ENGINEERS INC., WALNUT CREEK, CALIF.

The Out-of-Kilter Algorithm as a Single-Step
Method for Simulation and Optimization of
Vistula River Planning Alternatives,
W77-06735 4A

WATER RESOURCES ENGINEERS, SPRINGFIELD, VA.

Introduction to Urban Storm Water Runoff
Models,
W77-07071 5B

Simplified Methods of Computing the Quantity
of Urban Runoff,
W77-07072 5B

The WRE Storm Model,
W77-07073 5B

WATERLOO UNIV., (ONTARIO). DEPT. OF CIVIL ENGINEERING.

Use of a Parametric Model as a Tool for
Hydrometric Network Planning,
W77-06710 2A

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.

A Device for Measuring Seepage Flux in Lakes
and Estuaries,
W77-06903 7B

WESTERN WASHINGTON STATE COLL., BELLINGHAM.

Reconnaissance Characterization of Littoral
Biota, Beaufort and Chukchi Seas,
W77-06843 6G

WESTERN WASHINGTON STATE COLL., BELLINGHAM. DEPT. OF BIOLOGY.

Temperature Relations of Puget Sound Thaids
in Reference to Their Intertidal Distribution,
W77-06767 5C

WINNIPEG WATERWORKS, WASTE, AND DISPOSAL DIV. (MANITOBA).

The Chemical Characteristics of the City of
Winnipeg Waste Water,
W77-07047 5A

WISCONSIN UNIV.-MADISON.

Identity, Origin and Development of Off-
Flavors in Great Lakes Anadromous Fish,
W77-06931 5A

WISCONSIN UNIV., MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.

Lake Currents and Temperatures Near the
Western Shore of Lake Michigan,
W77-06687 2H

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.

Response of Macro-Zooplankton Populations
to Copper: Controlled Ecosystem Pollution Ex-
periment,
W77-06620 5A

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.

Zooplankton Sampling Variability: Controlled
Ecosystem Pollution Experiment,
W77-06615 5A

Response of Natural Marine Bacterial Popu-
lations to Copper: Controlled Ecosystem Pollu-
tion Experiment,
W77-06622 5A

WRIGHT WATER ENGINEERS, INC., DENVER, COLO.

New Design Gives Denver District Iron-Free
Well,
W77-06868 8A

WROCLAW TECHNICAL UNIV. (POLAND). INST. OF ENVIRONMENT PROTECTION ENGINEERING.

Renovated Water from Municipal Sewage
Treatment Plants,
W77-07086 5D

YALE UNIV., NEW HAVEN, CONN. DEPT. OF GEOLOGY AND GEOPHYSICS.

Interstitial Water Chemistry of Anoxic Long
Island Sound Sediments. 1. Dissolved Gases,
W77-06900 5B

YANKEE ATOMIC ELECTRIC CO., WESTBORO, MASS.

Evaluation of Alternative Solutions to Gas
Bubble Disease Mortality of Menhaden at Pil-
grim Nuclear Power Station,
W77-06928 5G

ACCESSION NUMBER INDEX

W77-06601	6D	W77-06679	5A	W77-06757	7B	W77-06835	6G
W77-06602	2G	W77-06680	5C	W77-06758	5C	W77-06836	6G
W77-06603	2G	W77-06681	2G	W77-06759	5C	W77-06837	3F
W77-06604	2G	W77-06682	5G	W77-06760	5F	W77-06838	6G
W77-06605	2G	W77-06683	2H	W77-06761	3F	W77-06839	6G
W77-06606	2G	W77-06684	5C	W77-06762	2F	W77-06840	6G
W77-06607	5C	W77-06685	5C	W77-06763	5C	W77-06841	6G
W77-06608	5C	W77-06686	5D	W77-06764	5C	W77-06842	6G
W77-06609	5C	W77-06687	2H	W77-06765	5C	W77-06843	6G
W77-06610	5C	W77-06688	5C	W77-06766	5C	W77-06844	2G
W77-06611	5C	W77-06689	5G	W77-06767	5C	W77-06845	6G
W77-06612	5C	W77-06690	5C	W77-06768	5C	W77-06846	6G
W77-06613	5A	W77-06691	3C	W77-06769	5C	W77-06847	6G
W77-06614	5C	W77-06692	5C	W77-06770	5C	W77-06848	6G
W77-06615	5A	W77-06693	5C	W77-06771	5C	W77-06849	6G
W77-06616	5A	W77-06694	5C	W77-06772	5C	W77-06850	5A
W77-06617	5A	W77-06695	5C	W77-06773	5C	W77-06851	5B
W77-06618	5A	W77-06696	5C	W77-06774	3B	W77-06852	2F
W77-06619	5A	W77-06697	5C	W77-06775	5C	W77-06853	5G
W77-06620	5A	W77-06698	5G	W77-06776	5C	W77-06854	8C
W77-06621	5A	W77-06699	5D	W77-06777	5C	W77-06855	5B
W77-06622	5A	W77-06700	5G	W77-06778	5A	W77-06856	8C
W77-06623	5A	W77-06701	5G	W77-06779	5C	W77-06857	8G
W77-06624	5A	W77-06702	5G	W77-06780	5C	W77-06858	4C
W77-06625	5A	W77-06703	6G	W77-06781	5A	W77-06859	5D
W77-06626	5A	W77-06704	6G	W77-06782	5C	W77-06860	8C
W77-06627	5A	W77-06705	6G	W77-06783	5C	W77-06861	5G
W77-06628	5C	W77-06706	6G	W77-06784	2I	W77-06862	5G
W77-06629	5C	W77-06707	5G	W77-06785	5C	W77-06863	8B
W77-06630	2C	W77-06708	2A	W77-06786	2H	W77-06864	2A
W77-06631	5D	W77-06709	2A	W77-06787	2I	W77-06865	8G
W77-06632	5B	W77-06710	2A	W77-06788	5C	W77-06866	8G
W77-06633	5G	W77-06711	6A	W77-06789	5C	W77-06867	8C
W77-06634	6B	W77-06712	6C	W77-06790	5C	W77-06868	8A
W77-06635	2I	W77-06713	4B	W77-06791	5D	W77-06869	8G
W77-06636	5C	W77-06714	4B	W77-06792	8I	W77-06870	3F
W77-06637	5C	W77-06715	4A	W77-06793	6G	W77-06871	3C
W77-06638	5C	W77-06716	4A	W77-06794	6G	W77-06872	2G
W77-06639	5C	W77-06717	4A	W77-06795	6G	W77-06873	4A
W77-06640	5A	W77-06718	4A	W77-06796	6G	W77-06874	2L
W77-06641	5A	W77-06719	4A	W77-06797	2B	W77-06875	5C
W77-06642	5C	W77-06720	4A	W77-06798	2H	W77-06876	5G
W77-06643	2B	W77-06721	4A	W77-06799	6G	W77-06877	5C
W77-06644	3B	W77-06722	4A	W77-06800	6G	W77-06878	6G
W77-06645	3B	W77-06723	4A	W77-06801	4D	W77-06879	2H
W77-06646	2B	W77-06724	4A	W77-06802	5C	W77-06880	2L
W77-06647	2B	W77-06725	4A	W77-06803	2I	W77-06881	2L
W77-06648	2L	W77-06726	4A	W77-06804	6G	W77-06882	2L
W77-06649	2H	W77-06727	4A	W77-06805	6G	W77-06883	8D
W77-06650	2L	W77-06728	4B	W77-06806	6G	W77-06884	2H
W77-06651	2L	W77-06729	4B	W77-06807	6G	W77-06885	8E
W77-06652	2B	W77-06730	4A	W77-06808	6G	W77-06886	5C
W77-06653	7B	W77-06731	6A	W77-06809	6G	W77-06887	2B
W77-06654	2L	W77-06732	4A	W77-06810	6G	W77-06888	8D
W77-06655	2H	W77-06733	4A	W77-06811	6G	W77-06889	2C
W77-06656	4D	W77-06734	4A	W77-06812	6G	W77-06890	2C
W77-06657	4D	W77-06735	4A	W77-06813	6G	W77-06891	2L
W77-06658	5B	W77-06736	6A	W77-06814	6G	W77-06892	2L
W77-06659	2B	W77-06737	6A	W77-06815	6G	W77-06893	2L
W77-06660	5A	W77-06738	6E	W77-06816	6G	W77-06894	2L
W77-06661	2C	W77-06739	6B	W77-06817	6G	W77-06895	2L
W77-06662	8A	W77-06740	4B	W77-06818	6G	W77-06896	2L
W77-06663	8A	W77-06741	5C	W77-06819	6G	W77-06897	2D
W77-06664	8A	W77-06742	5B	W77-06820	6G	W77-06898	2D
W77-06665	5A	W77-06743	5C	W77-06821	6G	W77-06899	5C
W77-06666	5A	W77-06744	5C	W77-06822	6G	W77-06900	5B
W77-06667	3E	W77-06745	4C	W77-06823	6G	W77-06901	2J
W77-06668	5B	W77-06746	5C	W77-06824	6G	W77-06902	5B
W77-06669	2L	W77-06747	5C	W77-06825	6G	W77-06903	7B
W77-06670	7B	W77-06748	5C	W77-06826	6G	W77-06904	2L
W77-06671	5G	W77-06749	5C	W77-06827	2I	W77-06905	2F
W77-06672	5G	W77-06750	5C	W77-06828	6G	W77-06906	5B
W77-06673	5A	W77-06751	5C	W77-06829	6G	W77-06907	2L
W77-06674	3B	W77-06752	5C	W77-06830	6G	W77-06908	5B
W77-06675	2B	W77-06753	5C	W77-06831	7C	W77-06909	5B
W77-06676	4A	W77-06754	5C	W77-06832	6G	W77-06910	5B
W77-06677	2L	W77-06755	5C	W77-06833	6G	W77-06911	5B
W77-06678	2B	W77-06756	5C	W77-06834	6G	W77-06912	5A

ACCESSION NUMBER INDEX

W77-06913

W77-06913	5B	W77-06992	8F	W77-07071	5B
W77-06914	5B	W77-06993	8G	W77-07072	5B
W77-06915	2C	W77-06994	8G	W77-07073	5B
W77-06916	2L	W77-06995	8G	W77-07074	5D
W77-06917	6B	W77-06996	5D	W77-07075	5B
W77-06918	6G	W77-06997	5D	W77-07076	5A
W77-06919	5C	W77-06998	5D	W77-07077	5D
W77-06920	5	W77-06999	5D	W77-07078	5D
W77-06921	5C	W77-07000	5D	W77-07079	5D
W77-06922	5C	W77-07001	5D	W77-07080	5D
W77-06923	5C	W77-07002	5E	W77-07081	5D
W77-06924	5C	W77-07003	5D	W77-07082	5D
W77-06925	5C	W77-07004	5D	W77-07083	5D
W77-06926	7B	W77-07005	5D	W77-07084	5D
W77-06927	5C	W77-07006	5D	W77-07085	5D
W77-06928	5G	W77-07007	5D	W77-07086	5D
W77-06929	8B	W77-07008	5D	W77-07087	5D
W77-06930	2L	W77-07009	5D	W77-07088	5D
W77-06931	5A	W77-07010	5D	W77-07089	5G
W77-06932	5B	W77-07011	5E	W77-07090	5D
W77-06933	5C	W77-07012	5D	W77-07091	5D
W77-06934	6G	W77-07013	5D	W77-07092	5D
W77-06935	5G	W77-07014	5D	W77-07093	5D
W77-06936	6G	W77-07015	5D	W77-07094	5D
W77-06937	2L	W77-07016	5D	W77-07095	5D
W77-06938	5A	W77-07017	5E	W77-07096	5B
W77-06939	2J	W77-07018	5E	W77-07097	5D
W77-06940	8G	W77-07019	5D	W77-07098	5A
W77-06941	4B	W77-07020	5E	W77-07099	5D
W77-06942	5A	W77-07021	5D	W77-07100	5D
W77-06943	7B	W77-07022	2B		
W77-06944	5A	W77-07023	5D		
W77-06945	5D	W77-07024	5D		
W77-06946	5E	W77-07025	5D		
W77-06947	5D	W77-07026	5D		
W77-06948	5D	W77-07027	5D		
W77-06949	5D	W77-07028	5D		
W77-06950	5D	W77-07029	5D		
W77-06951	5D	W77-07030	5D		
W77-06952	6F	W77-07031	5D		
W77-06953	4A	W77-07032	5D		
W77-06954	4A	W77-07033	5D		
W77-06955	6G	W77-07034	5D		
W77-06956	6B	W77-07035	5D		
W77-06957	6G	W77-07036	5G		
W77-06958	2H	W77-07037	5D		
W77-06959	7C	W77-07038	5G		
W77-06960	7B	W77-07039	5A		
W77-06961	5A	W77-07040	5B		
W77-06962	3F	W77-07041	5D		
W77-06963	2E	W77-07042	5D		
W77-06964	2J	W77-07043	5D		
W77-06965	2F	W77-07044	5A		
W77-06966	2E	W77-07045	5A		
W77-06967	2K	W77-07046	5D		
W77-06968	4B	W77-07047	5A		
W77-06969	4C	W77-07048	5D		
W77-06970	4B	W77-07049	5B		
W77-06971	4A	W77-07050	5C		
W77-06972	4A	W77-07051	5G		
W77-06973	2D	W77-07052	5G		
W77-06974	5B	W77-07053	5B		
W77-06975	5B	W77-07054	5B		
W77-06976	5E	W77-07055	5B		
W77-06977	4C	W77-07056	5B		
W77-06978	4B	W77-07057	5D		
W77-06979	2E	W77-07058	5D		
W77-06980	4D	W77-07059	5D		
W77-06981	5B	W77-07060	5D		
W77-06982	5C	W77-07061	5D		
W77-06983	5D	W77-07062	5D		
W77-06984	5B	W77-07063	5D		
W77-06985	5D	W77-07064	5D		
W77-06986	8G	W77-07065	5D		
W77-06987	5D	W77-07066	5B		
W77-06988	8E	W77-07067	5A		
W77-06989	5G	W77-07068	5D		
W77-06990	8G	W77-07069	5D		
W77-06991	8G	W77-07070	5A		

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W77-06870--06872	3
Cornell University, Policy Models for Water Resources Systems	W77-06707--06737	31
ERDA Oak Ridge National Laboratory, Nuclear Radiation and Safety	W77-06763--06773 06775--06783 06785 06788--06792	26
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W77-06983--07037 07039 07041--07066 07071--07100	112
Illinois State Water Survey, Hydrology	W77-06643--06678 06885--06916	68
National Water Well Association, Water Well Construction Technology	W77-06851--06857 06859--06863 06865--06869	17
University of North Carolina, Metropolitan Water Resources Planning and Management	W77-06601--06606 06952--06957	12
University of Wisconsin, Eutrophication	W77-06679--06680 06682--06690 06692--06697	17
University of Wisconsin, Water Resources Economics	W77-06698--06706	9
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W77-06631--06634 06740--06742 06760--06762 06917, 06982	12

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER		
BioSciences Information Service	W77-06681, 06691 06745, 06774 06784 06786--06787 06797--06798 06801--06803 06827, 06831 06837--06838 06844, 06858 06864, 06926 06962, 07038 07040 07067--07070	27
Environmental Information Services, Inc. (Gas Bubble Disease)	W77-06919--06925 06927--06928	9
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W77-06607--06629 06635--06642 06743--06744 06746--06759	47
Environment Canada (WATDOC)	W77-06941--06951	11
National Oceanic and Atmospheric Administration	W77-06873--06884 06929--06940	24
Ocean Engineering Information Service (Outer Continental Shelf)	W77-06793--06796 06799--06800 06804--06826 06828--06830 06832--06836 06839--06843 06845--06850	48
Office of Water Research and Technology	W77-06630 06738--06739 06918	4
U. S. Geological Survey	W77-06958--06961 06963--06981	23

L

7

9

7

1

4

8

4

3